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SOIL-VEGETATION RELATIONSHIPS ON RANGELAND EXCLOSURES IN THE GRASS CREEK PLANNING UNIT OF NORTH CENTRAL WYOMING

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SOIL-VEGETATION RELATIONSHIPS ON RANGELAND EXCLOSURES IN THE GRASS CREEK PLANNING UNIT OF NORTH CENTRAL WYOMING[1]

BY

H. G. Fisser, D. C. Trueblood, and D. D. Samuelson[2]

1979

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INTRODUCTION

Soil-vegetation relationships have long been recognized as important. In order to comprehensively define some of these relationships in western Wyoming, the University of Wyoming and Bureau of Land Management entered into an agreement which specifically relates to three planning unit areas. Within these areas several rangeland exclosures were constructed in years past from which vegetation and site data have been obtained and recorded. Vegetation data included herbage production, cover, and composition values from as early as 1960; some obtained annually and some less often. Environmental information such as moisture, temperature, and soil description were recorded at some exclosure sites.

The geographic distribution of the exclosures provides great vegetation diversity and significant heterogeniety of environmental characteristics, including soils. It appeared reasonable to assume that comprehensive study of soils and vegetation data from these exclosure sites could provide important information not presently well defined, or in some instances, even known. Definitive statements of objectives developed for this program of investigation are (1) to inventory and characterize soils within rangeland exclosures and (2) to interrelate the soil characteristics with long term vegetation data.

The soil inventory and soil-vegetation relationship information from these exclosures can provide a valuable data base for use by the Bureau of

Land Management to increase effectiveness of decision processes applied to rangeland resource management and use. In addition, these data will contribute to the better understanding of rangeland synecological relationships within the scientific community and can enhance information transfer to those concerned with use and management of natural resources.

DESCRIPTION OF THE STUDY AREA

This study was done on 39 exclosures in the Grass Creek Planning Unit which is located in the Big Horn Basin of north central Wyoming (Figure 1, Table 1). This is an area of little precipitation, high summer temperatures and high evaporation with soils that tend to be alkaline and calcareous. Much of the vegetation is dominated by shrubs, principally Gardner's saltbush (Atriplex gardneri) and big sagebrush (Artemisia tridentata). For a detailed description of the environment at each exclosure, see the soil profile descriptions (Appendix A).

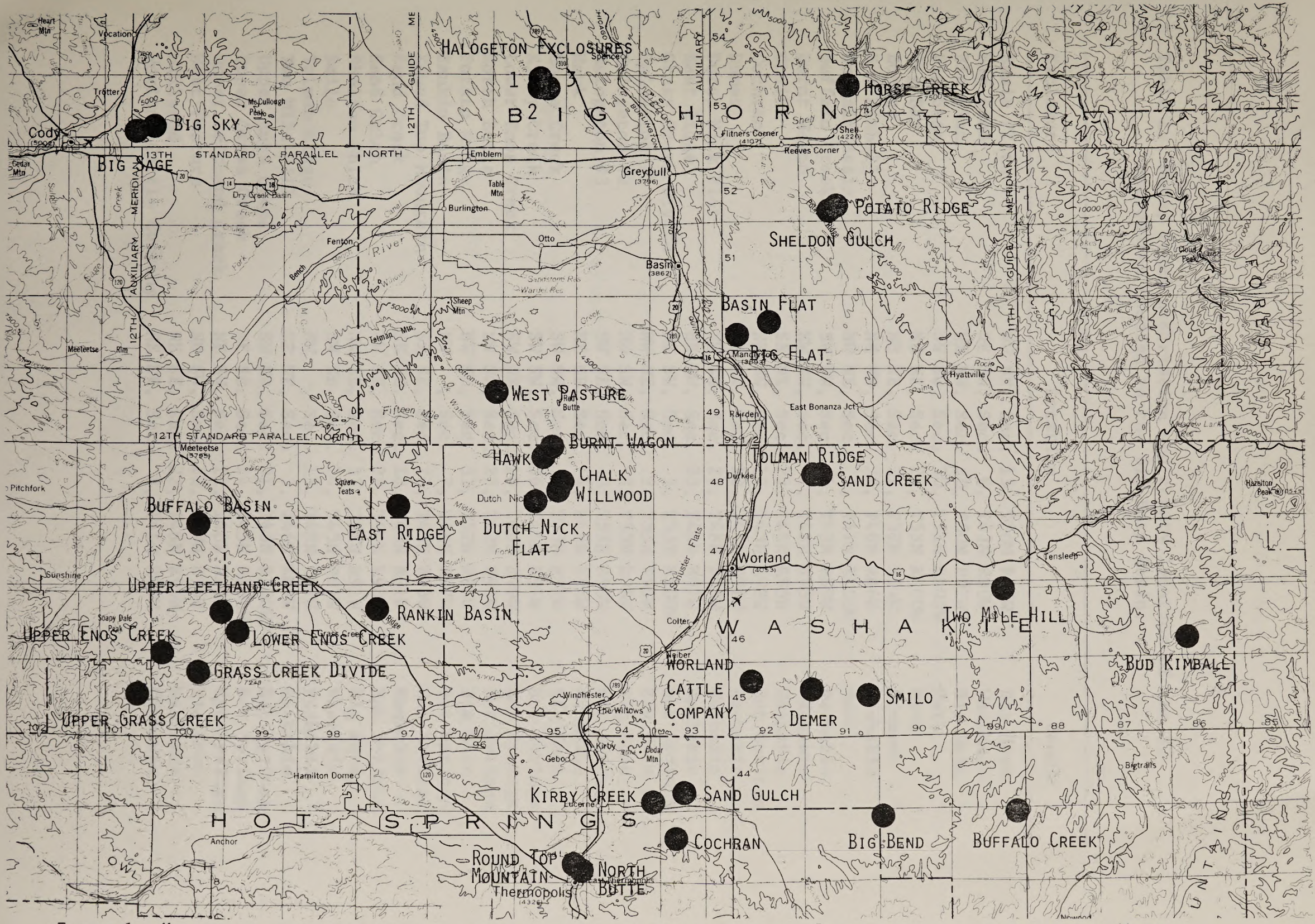


FIGURE 1. MAP OF THE STUDY AREA SHOWING LOCATIONS OF THE EXCLOSURES STUDIED. BOYSEN EXCLOSURE IS NOT SHOWN. (ADAPTED FROM U.S. GEOLOGICAL SURVEY WYOMING BASE MAP).

Table 1. Name, legal description and county location of the 39 exclosures studied in the Big Horn Basin.

Exclosure	Location	County
Basin Flats	NW NE, Sec. 15, T50N R93W	Big Horn
Big Bend	NE SW, Sec. 6, T43N R90W	Washakie
Big Flat	NE NW, Sec. 20, T50N R92W	Big Horn
Big Sage	NW SW, Sec. 30, T53N R100W	Park
Big Sky	NE NE, Sec. 29, T53N R100W	Park
Boysen	NE NE, Sec. 21, T39N R94W	Fremont
Bud Kimball	NE NW, Sec. 28, T46N R86W	Washakie
Buffalo Basin	NW NE, Sec. 3, T47N R100W	Park
Buffalo Creek	SW NW, Sec. 1, T43N R89W	Washakie
Burnt Wagon	NW NW, Sec. 4, T48N R95W	Washakie
Chalk	SE NE, Sec. 22, T48N R95W	Washakie
Cochran	NE NW, Sec. 17, T43N R93W	Hot Springs
Demer	NE NW, Sec. 18, T45N R91W	Washakie
Dutch Nick Flat	NW SW, Sec. 29, T48N R95W	Washakie
East Ridge	SE NW, Sec. 33, T48N R97W	Washakie
Grass Creek Divide	NE SW, Sec. 3, T53N R100W	Hot Springs
Halogeton #1	NW NE, Sec. 3, T53N R95W	Big Horn
Halogeton #2	NW SW, Sec. 2, T53N R95W	Big Horn
Halogeton #3	SW SE, Sec. 3, T53N R95W	Big Horn
Hawk	NE NE, Sec. 4, T48N R95W	Washakie
Horse Creek	SW SW, Sec. 1, T53N R91W	Big Horn
Kirby Creek	SW NW, Sec. 36, T44N R94W	Hot Springs
Lower Enos Creek	SW NE, Sec. 19, T46N R99W	Hot Springs
North Butte	SW SW, Sec. 25, T43N R95W	Hot Springs
Potato Ridge	NW NE, Sec. 33, T52N R91W	Big Horn
Rankin Basin	NW , Sec. 7, T46N R97W	Hot Springs
Round Top Mountain	SE SE, Sec. 26, T43N R95W	Hot Springs
Sand Creek	SE NE, Sec. 18, T48N R91W	Washakie
Sand Gulch	NW SE, Sec. 29, T44N R93W	Hot Springs
Sheldon Gulch	NW NE, Sec. 33, T52N R91W	Big Horn
Smilo	SW SE, Sec. 14, T45N R91W	Washakie
Tolman Ridge	NW , Sec. 18, T48N R91W	Washakie
Two Mile Hill	SE NE, Sec. 3, T46N R89W	Washakie
Upper Enos Creek	SW NE, Sec. 31, T45N R100W	Hot Springs
Upper Grass Creek	NE SE, Sec. 14, T45N R101W	Hot Springs
Upper Lefthand Creek	NE SW, Sec. 12, T46N R100W	Hot Springs
West Pasture	NE SW, Sec. 12, T49N R96W	Big Horn
Willwood	NE SE, Sec. 22, T48N R95W	Washakie
Worland Cattle Company	NE NE, Sec. 8, T45N R92W	Washakie

METHODS

SOILS

For the purpose of the methods section it is convenient to divide the soils work into three discussions: (1) profile description, (2) lab analyses done at the Univeristy of Wyoming and (3) supplemental lab analyses done at the University of Idaho soils lab.

Profile Descriptions

At least one soil pit was dug in each exclosure. In exclosures with more than one soil type, a pit was dug in each. The profiles were described, using standard procedures, by either James R. Stephens, State Soil Specialist, Soil Conservation Service, in 1977 and 1978 or by Clarence J. Fowkes, Soil Conservation Service, in 1971 (Appendix A).

Lab Analyses (University of Wyoming)

Lab analyses were performed on samples from each horizon, taken at the time the profile was described, using methods of the University of Wyoming soils lab (Appendix B). Also utilized were lab analyses from previous work by Ronald Ries (1973), whose data were derived by identical procedures except for the determination of calcium carbonate. The work done by Ries was limited to horizons within the actual rooting depth. Analyses conducted and methodological procedures are listed below.

1. Percentage Coarse Fragments were determined by sieving through a 2 mm screen during preliminary processing.

2. Percentage Sand, Silt, and Clay were determined by the hydrometer method (Bouyoucos, 1936).

3. Percentage Very Fine Sand was determined by wet sieving through a number 140 and a number 270 sieve and after drying (110°C for 24 hours) was weighed and expressed as a percentage of the total soil less coarse fragments.

4. Bulk Density was determined using clods from each horizon collected in the field and coated with saran dissolved in Methyl ethyl ketone (Soil Conservation Service, 1972, modified). These clods were dried and weighed and the volume measured by displacement of water.

5. pH was determined using a glass electrode pH meter both on a saturated soil paste and on a 1:5 dilution.

6. Electrical Conductivity (EC) was determined on an extract of a soil paste using a conductivity bridge (U.S. Salinity Laboratory, 1954).

7. Percentage Organic Matter was determined by the Walkley and Black method (1934).

8. Calcium Carbonate Equivalant was determined by the rapid titration method (U.S. Salinity Laboratory, 1954). For analyses conducted by Ries (1973) a method measuring CO_2 evolved by the addition of hydrochloric acid was used.

9. Percentage Soil Moisture Holding Capacity was determined in the laboratory at 1/3 and 15 bars on soil passed through a 2mm sieve (fines) and on the saran coated clods (profile) using a pressure plate apparatus (Soil Conservation Service, 1972, modified).

10. Potential Available Moisture was determined in the laboratory both for the profile (saran coated clods) and for the fines (<2mm) as the difference between the percentage soil moisture at 1/3 and at 15 bars.

11. Rooting Depth (Effective) was determined as the depth to an impenetrable layer (J. R. Stephens, personal communications). Actual rooting depth may be obtained from the profile descriptions.

Supplemental Lab Analyses (University of Idaho)

Supplemental lab analyses were performed by the soils lab staff at the University of Idaho, Moscow (Appendix B). Analyses performed were:

1. Cation exchange capacity.
2. Gypsum content.
3. Soluble cations for calcium, magnesium, sodium, and potassium.
4. Exchangeable cations for calcium, magnesium, sodium, and potassium.

The results from this lab were checked by duplicates of 10 samples which were sent to Front Range Labs, Fort Collins, Colorado. Numerical values were quite similar although some arithmatic modification was required in order to have all values in identical unit measures.

VEGETATION

All vegetation data was taken from the annual progress reports of an on-going cooperative research project with the Bureau of Land Management (Fisser, et. al. 1962-1978) and from research files at the University of Wyoming. For detailed discussion of the methods used refer to these reports. The vegetation data is presented as long term means for cover and production for shrubs, perennial grasses, annual grasses, perennial forbs, annual forbs, and total (Appendices C and D).

RESULTS

In discussing results, the soils and vegetation are addressed separately and then combined for discussion of soil-vegetation relationships.

SOILS

For the 39 exclosures there are 50 profile descriptions (Appendix A). The profile description for one pit (Dutch Nick Flat) was not available. There are, then, 51 "study sites". For those exclosures in which there is only one soil type, the study site and profile descriptions are identified by the exclosure name. For those exclosures including more than on soil type, the study sites and profile descriptions are differentiated by the exclosure name plus some identifying characteristic. This differentiating characteristic may be a description of the position of the site on a topographic gradient within the exclosure, a description of the dominant vegetation, or, if neither of the above was definitive, the location of the site within the exclosure was identified. When a description of the vegetation was used the species code for one or two dominant, but differentiating, species follows the exclosure name. These species codes are formed by combining the first two letters of the genera name with the first two letters of the species name (Table 2). Whatever method is used for differentiation, all study sites within an exclosure are identified by the same method, and the study site and its corresponding profile description are identified by the same name.

Table 2. List of plants with code acronym; genus and species with which specific study sites were identified at some of the Multiple Type exclosures.

Species Code	Name
AGSM	Agropyron smithii
AGSP	" spicatum
ARNO	Artemisia nova
ARSP	" spinescens
ARTR	" tridentata
ATGA	Atriplex gardneri
GRSP	Grayia spinosa

The soil at each site was classified according to the new comprehensive classification system (Soil Taxonomy) (Table 3). The distribution of the soils among the orders is as might be expected as related to the semi-arid temperate climate of the area (Table 4). Sixty-two percent of the soils are in the order Aridisol and 20 percent in the order Entisol. A dry climate determines the Aridisol order and may also severely restrict development of soils thus producing Entisols. The other two orders occurred at peripheral foothill sites which received significantly greater precipitation than the lower elevation areas within the Big Horn Basin.

Most of the sub-orders present are characterized by high clay content of the soil or related to the influence of low mean annual temperature upon soil development. The sub-orders not distinguished by these characteristics encompass only a few study sites and are commonly present as minimal components in large geographical areas such as the Big Horn Basin.

Comparisons of soil chemical properties will be made throughout this report using a single numerical value for each property at each study site. Each value represents the mean for all horizons within the rooting depth at a specific study site. The chemical properties of the soils vary widely (Table 5).

Of the 34 total soil series found within the 39 exclosures (51 study sites) only nine occur at more than one study site (Table6). This diversity of soil series represents important physical and chemical variations that will be evaluated in greater detail in subsequent portions of this report. These nine soil series are identified below with descriptive information identifying the exclosures on which they occurred with further expression identifying situations of similar and/or dissimilar chemical properties

Table 3. Taxonomic soil orders and sub-order terms at the 51 study sites of the 39 exclosure locations in the Big Horn Basin.

Study Site	Order	Sub-order
Basin Flats (ARTR)	Entisol	Orthent
" " (ATGA)	Aridisol	Argid
Big Bend	Aridisol	Argid
Big Flat	Entisol	Fluvent
Big Sage	Aridisol	Argid
Big Sky	"	"
Boysen	"	"
Bud Kimball	"	"
Buffalo Basin	"	Orthid
Buffalo Creek	Aridisol	Argid
Burnt Wagon	"	"
Chalk	"	"
Cochran	Aridisol	Argid
Demer	"	"
Dutch Nick Flat	*	*
East Ridge (ARTR)	Entisol	Orthent
" " (ATGA)	Aridisol	Argid
Grass Creek Divide (Type A)	Mollisol	Boroll
" " " (Type B)	Entisol	Orthent
" " " (Type C)	Alfisol	Boralf
" " " (Type D)	Aridisol	Argid
Halogeton #1 (East)	"	"
" #1 (West)	"	"
" #2	"	"
" #3 (Ridge)	Entisol	Orthent
" #3 (Swale)	Aridisol	Argid
Hawk (ATGA)	Entisol	Orthent
" (GRSP)	Entisol	Psamment
Horse Creek (ARNO)	"	Orthent
" " (AGSM)	"	"
" " (AGSP)	"	"
Kirby Creek	Entisol	Fluvent
Lower Enos Creek	Aridisol	Argid
North Butte	"	"
Potato Ridge	Entisol	Fluvent
Rankin Basin	Aridisol	Argid
Round Top Mountain	Entisol	Orthent
Sand Creek (ARSP)	Aridisol	Argid
" " (ARTR)	Aridisol	Argid
Sand Gulch	"	"
Sheldon Gulch	"	Orthid
Smilo	Aridisol	Argid
Tolman Ridge	"	"
Two Mile Hill	"	"
Upper Enos Creek	Alfisol	Boralf
" Grass Creek	Mollisol	Boroll
" Lefthand Creek	Aridisol	Argid
West Pasture	"	"
Willwood	Entisol	Orthent
Worland Cattle Company (Ridge)	"	"
" " " (Swale)	Aridisol	Argid

*Data Unavailable

Table 4. Distribution of the study sites among the 4 soil orders and the 7 sub-orders present.

Order	Sub-order	Number of study sites
Aridisol		31
	Argid	29
	Orthid	2
Entisol		15
	Fluvent	3
	Orthent	11
	Psamment	1
Alfisol	Boralf	2
Mollisol	Boroll	2

Table 5. Ranges of soil chemical properties studied.[1]

Chemical Property	High	Low
Percent Coarse (<2mm)	13.9	0
" Sand	81.0	17.8
" Silt	54	10.7
" Clay	56.7	5.3
" Very Fine Sand	47.1	5.5
Bulk Density	1.52	1.05
pH paste	8.7	4.6
" 1:5	9.7	5.3
Electrical Conductivity (mmho)	11.08	.32
Percent Organic Matter	5.9	.2
Percent Calcium Carbonate	34.6	.3
Percent Soil Moisture Holding Capacity		
Profile 1/3 bar	32.4	9.7
15 bar	12.0	3.5
Available	22.1	5.4
Fines 1/3 bar	33.1	8.0
15 bar	16.0	3.6
Available	25.6	4.4
Soluble Cations (meq/100g)		
Na	4.3	0
Ca	1.8	0
Mg	2.0	0
K	.1	0
Exchangeable Cations $(\frac{meq}{100\ g})$		
Na	4.2	.1
Ca	51.0	3.7
Mg	8.4	.6
K	21.9	.2
Cation Exchange Capacity (meq/100g)	37.6	6.0
Gypsum Content (meq/100g)	39.6	0

[1]Each value represents the mean of all horizons within the rooting depth at a specific study site.

Table 6. Soil series occurring at multiple study sites and the number of sites at which they occur.[1]

Series	Number of Sites
Bributte	2
Effington	5
Fort Collins	2
Griffy	2
Mudray	4
Muff	3
Persayo	3
Thedalund	2
Ulm	2

[1]Names of the remaining 25 soil series are given with the soil profile descriptions (Appendix A).

which were noted within a soil series represented by more than one study site.

Bributte: The Bributte series occurs on two study sites, Hawk (ATGA) and Willwood. Some of the soil chemical properties at these sites are very similar, some are moderately similar, and some are dissimilar.

Effington: The Effington series occurs on five study sites, East Ridge (ATGA), Halogeton #3 (Swale), Sand Creek (ARSP), Tolman Ridge, and Two Mile Hill. Some of the soil chemical properties at these sites are similar, but some are dissimilar.

Fort Collins: The Fort Collins series occurs on two study sites, Big Bend and Buffalo Creek. Some of the soil chemical properties at these sites are similar but many are dissimilar.

Griffy: The Griffy series occurs on two study sites, Demer and Sand Creek (ARTR). Few of the soil chemical properties at these sites are similar.

Mudray: The Mudray series occurs on four study sites, Basin Flats (ATGA), Burnt Wagon, Chalk, and Halogeton #1 (West). Some of the soil chemical properties on these sites are similar, but many are dissimilar.

Muff: The Muff series occurs on three study sites, Halogeton #1 (East), Sand Gulch, and Worland Cattle Company (Swale). Some of the soil chemical properties at these sites are similar, but many are dissimilar.

Persayo: The Persayo series occurs on three study sites, Basin Flats (ARTR), East Ridge (ARTR), and Halogeton #3 (Ridge). Few of the soil chemical properties at these sites are similar.

Thedalund: The Thedalund series occurs on two study sites at the Horse Creek Exclosure (ARTR/AGSM and ARTR/AGSP). Many of the soil chemical

properties at these sites are similar.

Ulm: The Ulm series occurs on two study sites, Bud Kimball and Cochran. Many of the soil chemical properties at these sites are similar.

VEGETATION

Of the 51 study sites, three; Halogeton #1 (West), Halogeton #3 (Swale); and Worland Cattle Company (Swale); have no specific vegetation data. There are, however, general vegetation descriptions, obtained by observation at the sites, which give the dominant species (Table 7). Of the other study sites all have cover data (Appendix C) and 20 have production data (Appendix D). For those exclosures within which sampling was done in more than one type of vegetation, the results for each type are designated by the exclosure name plus a species code for one or two dominant, but differentiating species. The two vegetative parameters studied, percent cover and total annual production, will be discussed separately.

Vegetation Cover

Nearly 80 percent (40 sites) fall into two types, saltbush (17) and sagebrush-grass (23), with the remainder a variety of seven other vegetation types (Table 8). This seems to follow the general distribution of vegetation in the study area. Of the three prominant vegetation groups, the sagebrush-grass type tends to have a greater cover of total vegetation than does the saltbush type. The grass type (4 sites) exhibits intermediate values (Table 9). This relationship changes, however, when only understory cover is considered. The sagebrush-grass type still has values greater than the saltbush type, but the grass type with 9.84% cover of understory species, is larger than either. This is to be expected

Table 7. Dominant overstory and understory species at the 51 study sites.

Study Site	Dominant Overstory Species	Dominant Understory Species
Basin Flats (ARTR)	Artemisia tridentata	Sitanion hystrix
" " (ATGA)	Atriplex gardneri	Poa sandbergii
Big Bend	Artemisia tridentata	Poa sandbergii
Big Flat	Atriplex gardneri	Sitanion hystrix
Big Sage	Artemisia tridentata	Bouteloua gracilis
Big Sky	" "	Poa sandbergii
Boysen	**	Bouteloua gracilis
Bud Kimball	Artemisia tridentata	Poa sandbergii
Buffalo Basin	" "	Koeleria cristata
Buffalo Creek	" "	Agropyron spicatum
Burnt Wagon	Atriplex gardneri	Sitanion hystrix
Chalk	Artemisia pedatifida	Sitanion hystrix
Cochran	" tridentata	Poa sandbergii
Demer	" "	Bouteloua gracilis
Dutch Nick Flat	**	Bouteloua gracilis
East Ridge (ARTR)	Artemisia tridentata	Poa sandbergii
" " (ATGA)	Atriplex gardneri	Sitanion hystrix
Grass Creek Divide (Type A)	Artemisia tridentata	Agropyron smithii
" " " (Type B)	**	Danthonia unispicata
" " " (Type C)	Artemisia tridentata	Festuca idahoensis
" " " (Type D)	" "	Arenaria hookeri
Halogeton #1 (East)	Atriplex gardneri	Sitanion hystrix
" #1 (West)	*	*
" #2	Atriplex gardneri	Sitanion hystrix
" #3 (Ridge)	" "	" "
" #3 (Swale)	*	*
Hawk (ATGA)	Atriplex gardneri	***
" (GRSP)	Grayia spinosa	Bouteloua gracilis
Horse Creek (ARNO)	Artemisia nova	Agropyron spicatum
" " (AGSM)	" tridentata	" smithii
" " (AGSP)	" "	Agropyron spicatum
Kirby Creek	Sarcobatus vermiculatus	Poa sandbergii
Lower Enos Creek	**	Koeleria cristata
North Butte	Artemisia tridentata	Agropyron spicatum
Potato Ridge	Atriplex gardneri	Sitanion hystrix
Rankin Basin	Artemisia tridentata	Bouteloua gracilis
Round Top Mountain	" "	Agropyron spicatum
Sand Creek (ARSP)	Artemisia spinescens	Poa sandbergii
" " (ARTR)	" tridentata	Agropyron smithii
Sand Gulch	Atriplex gardneri	Agropyron smithii
Sheldon Gulch	" "	***
Smilo	Artemisia tridentata	Poa sandbergii
Tolman Ridge	Atriplex gardneri	Sitanion hystrix
Two Mile Hill	" "	Sitanion hystrix
Upper Enos Creek	Juniperus scopulorum	Agropyron smithii
" Grass "	Pinus flexilus	Agropyron spp.
" Lefthand "	Artemisia tridentata	Festuca idahoensis
West Pasture	Atriplex gardneri	Sitanion hystrix
Willwood	" "	***
Worland Cattle Co. (Ridge)	Artemisia tridentata	Bouteloua gracilis
" " " (Swale)	*	*

* No Data Available
** Grass Type (No Overstory)
*** No Understory

Table 8. Vegetation types of the 51 study sites at the 39 exclosure locations in the Big Horn Basin.

Study Site	Vegetation Type
Basin Flats (ARTR)	Sagebrush--grass
Basin Flats (ATGA)	Saltbush
Big Bend	Sagebrush--grass
Big Flat	Saltbush
Big Sage	Sagebrush--grass
Big Sky	" "
Boysen	Grass
Bud Kimball	Sagebrush--grass
Buffalo Basin	" "
Buffalo Creek	" "
Burnt Wagon	Saltbush
Chalk	Birdsfoot sagewort
Cochran	Sagebrush--grass
Demer	" "
Dutch Nick Flat	Grass
East Ridge (ARTR)	Sagebrush--grass
East Ridge (ATGA)	Saltbush
Grass Creek Divide (Type A)	Sagebrush--grass
Grass Creek Divide (Type B)	Grass
" " " (Type C)	Sagebrush--grass
" " " (Type D)	Sagebrush--grass
Halogeton #1 (East)	Saltbush
" #1 (West)	"
" #2	"
" #3 (Ridge)	"
" #3 (Swale)	"
Hawk (ATGA)	"
" (GRSP)	Hopsage
Horse Creek (ARNO)	Sagebrush--grass
" " (AGSM)	" "
" " (AGSP)	" "
Kirby Creek	Greasewood
Lower Enos Creek	Grass
North Butte	Sagebrush--grass
Potato Ridge	Saltbush
Rankin Basin	Sagebrush--grass
Round Top Mountain	" "
Sand Creek (ARSP)	Bud Sagewort
" " (ARTR)	Sagebrush--grass
Sand Gulch	Saltbush
Sheldon Gulch	"
Smilo	Sagebrush--grass
Tolman Ridge	Saltbush
Two Mile Hill	"
Upper Enos Creek	Juniper
Upper Grass Creek	Pine
Upper Lefthand Creek	Sagebrush--grass
West Pasture	Saltbush
Willwood	"
Worland Cattle Company (Ridge)	Sagebrush--grass
Worland Cattle Company (Swale)	Annual Weeds

Table 9. Ranges[1] and means for total and understory vegetative cover for the nine vegetation types at the 39 exclosure locations in the Big Horn Basin.

Vegetation Type	Percent Cover					
	Total			Understory		
	High	Low	Mean	High	Low	Mean
Sagebrush--grass	28.07	6.72	16.40	13.47	.20	5.80
Grass	18.53	10.05	14.00	15.67	6.28	9.84
Saltbush	16.25	5.99	10.22	4.95	.03	1.57
Hopsage			24.08			1.47
Birdsfoot sagewort			21.83			.24
Juniper			19.75			9.06
Pine			19.60			10.60
Bud Sagewort			10.61			.54
Greasewood			8.54			3.29

[1]Open data entries represent types with only one site.

Table 10. Ranges and means of total and understory annual production for each of the vegetation types.[1]

Vegetation Types / Study Sites	Annual Production (lbs/acre)					
	Total			Understory		
	High	Low	Mean	High	Low	Mean
Sagebrush--grass	708.58	317.48	531.02	621.89	147.49	353.96
Saltbush	717.01	280.78	500.12	342.80	21.10	170.75
Grass	407.85	273.05	340.45	353.02	255.80	304.41
Greasewood			784.82			659.23

[1]Open data entries represent a type with only one site.

because the total cover is mostly understory in the grass type while it is largely overstory in the other two types. The saltbush is considered an overstory species in the previous sentences.

The seven other types have both total and understory cover values greater, lesser, and intermediate to those of the three most prominant types. Because there was only one sample per type the data may not be completely representative of all occurrences of these types in the Big Horn Basin.

Vegetation Production

Of the nine vegetation types, production data is available on four (Table 10). Of the three vegetation types with more than one sample both total and understory production was highest for the sagebrush-grass type. The grass type was lowest in total production but nearly equal to the production of the sagebrush-grass type in the understory which is to be expected because a large part of the total production of both the sagebrush-grass type and the saltbush type is from the overstory while there is relatively little overstory production in the grass type.

Soil Series at Multiple Sites

The soil series that occur at more than one site are distributed between the sagebrush-grass and saltbush vegetation types with three other types mixed in (Table 11). Four of the nine series include sites of two vegetation types. In three of these all of the types included are dominated by alkaline tolerant species. The other series (Persayo) is found on sites with soil chemical properties within levels of overlap between the extremes of the sagebrush-grass and saltbush types.

Table 11. Distribution of vegetation types among the soil series occurring on multiple sites.

Soil Series	Study Site	Vegetation Type
Bributte		
	Hawk (ATGA)	Saltbush
	Willwood	"
Effington		
	East Ridge (ATGA)	Saltbush
	Halogeton #3 (Swale)	"
	Sand Creek (ARSP)	Bud Sagewort
	Tolman Ridge	Saltbush
	Two Mile Hill	"
Fort Collins		
	Big Bend	Sagebrush--grass
	Buffalo Creek	" "
Griffy		
	Demer	Sagebrush--grass
	Sand Creek (ARTR)	" "
Mudray		
	Basin Flats (ATGA)	Saltbush
	Burnt Wagon	"
	Chalk	Birdsfoot Sagewort
	Halogeton #1 (West)	Saltbush
Muff		
	Halogeton #1 (East)	Saltbush
	Worland Cattle Co. (Swale)	Annual Weeds
Persayo		
	Basin Flats (ARTR)	Sagebrush--grass
	East Ridge (ARTR)	" "
	Halogeton #3 (Ridge)	Saltbush
Thedalund		
	Horse Creek (AGSM)	Sagebrush--grass
	" " (AGSP)	" "
Ulm		
	Bud Kimball	Sagebrush--grass
	Cochran	

SOIL-VEGETATION RELATIONSHIPS

The soil-vegetation relationships section is separated into sub-sections, each of which discuss the relationship of the vegetation parameters; vegetative type, percent cover, and annual production, with a single soil property. Vegetation production and cover comparisons are discussed within vegetation types for each soil property. In addition, the last sub-section compares the soil-vegetation relationships for those sites that are classified in the same soil series.

Soil Type

The vegetation types are fairly well distributed among the orders when it is taken into account that the orders encompass different numbers of sites (Table 12). If the order Aridisol is broken down into the three great groups present and if the order Entisol is broken down into the sub-orders present it is found that most of the less common vegetation types occur on the less common soil types and that within the order Aridisol, the sodium tolerant and relatively sodium intolerant vegetation types separate at the great group level. This is because the Natrargids must have high amounts of sodium and the Haplargids may not. There seems to be little relationship between soil type and either cover or production for these sites (Table 13).

Coarse Fragments

The percentage of coarse fragments appears to have no relationship to vegetative types, percent cover, or production for the areas studied.

Table 12. Distribution of the vegetation types among the soil orders, sub-orders, and some of the great groups which occurred at the 39 exclosure locations.

Order	Sub-order	Great Group	VEGETATION TYPES									
			Sagebrush Grass	Saltbush	Grass	Bud Sagewort	Birdsfoot Sagewort	Greasewood	Hopsage	Juniper	Pine	Annual Weeds
Aridisol			14	12	2	1	1					1
	Argid	Haplargid	13	11	2	1	1					1
		Natrargid	1	11	2	1	1					1
	Orthid	Camborthid	1	1								
Entisol			7	5	1			1	1			
	Orthent	Torriorthent	7	3	1			1				
	Fluvent	Torrifluvent		2					1			
	Psamment	Torripsamment										
Alfisol	Boralf	Eutroboralf	1							1		
Mollisol	Boroll		1								1	
		Argiboroll	1								1	
		Cryoboroll										

Table 13. Ranges and means for percent cover and total annual production for each soil order, sub-order, and great group which occurred at the 39 exclosure locations.

Order	Sub-order	Great Group	Percent Cover			Total Annual Production		
			High	Low	Mean	High	Low	Mean
Aridisol			27.83	5.99	13.94	717.01	273.05	484.02
	Argid		27.83	5.99	13.58	717.01	273.05	484.02
		Haplargid	27.83	6.72	15.86	698.75	273.05	497.72
		Natrargid	21.83	5.99	10.91	717.01	280.78	472.28
	Orthid		21.03	16.25	18.64	*	*	*
Entisol			27.29	7.77	13.14	784.82	493.69	596.10
	Orthent		27.29	7.77	12.91	708.58	493.69	558.35
	Fluvent		13.13	8.54	10.36			784.82
	Psamment				24.08	*	*	*
Alfisol			28.07	19.75	23.91	*	*	*
Mollisol			19.60	17.40	18.50	*	*	*

*--No Data Available

Texture

The percentages of sand, silt, clay, or very fine sand do not appear to have any relationship with the vegetative type, nor do the percentages of sand, clay, or very fine sand seem to have any relationship with either percent cover or annual production. The percentage of silt, however, seems to be related to production within the saltbush type. Specifically, the total production appears to be higher on soil that has a high amount of silt or a low amount of silt and appears to be at a lower level on sites with moderate amounts of silt (Table 14). Other interacting factors are obviously functionally related in this situation.

Bulk Density

The bulk density of the soil does not appear to have any relationship to either the vegetative type that occurs on it or to the total production within any type. It does, however, seem to be inversely related to the percent vegetative cover within the grass type (Table 15).

pH

Both the pH of a saturated soil paste and that of a 1:5 dilution appear to be related to the vegetative type that grows on that site (Table 16). The best distinction is among vegetation types dominated by species that are tolerant of alkaline conditions (birdsfoot sagewort, greasewood, hopsage, bud sagewort, saltbush, and annual weeds), those dominated by species that are not (pine and juniper), and those dominated by species that are moderately tolerant (sagebrush). Distinctions within these groups are less obvious and probably can not be made with confidence. The mean of the grass type falls between those of the moderately tolerant group but the range of this type covers both extremes. This is probably

Table 14. Comparison of the percentage of silt with total production for the saltbush vegetation type.

Study Site	Percent Silt	Total Production (lbs/acre)
Halogeton #3 (Ridge)	15.0	512.33
Halogeton #1 (East)	23.8	447.32
West Pasture	24.5	396.36
Burnt Wagon	26.8	280.78
Halogeton #2	29.6	555.13
Two Mile Hill	41.7	591.90
Sand Gulch	47.2	717.01

Table 15. Comparison of bulk density with percent vegetative cover within the grass vegetation type.

Study Site	Bulk Density (g/cm^3)	Percent Cover
Boysen	1.36	10.05
Grass Creek Divide (Type B)	1.32	13.69
Lower Enos Creek	1.31	13.73
Dutch Nick Flat	1.28	18.53

Table 16. Comparison of the ranges[1] and means of pH of both a saturated soil paste and a 1:5 dilution among vegetation types.

Vegetation Type	pHs			pHs		
	High	Low	Mean	High	Low	Mean
Birdsfoot Sagewort			8.5			9.6
Greasewood			8.4			9.5
Hopsage			8.5			9.4
Bud Sagewort			8.4			9.3
Saltbush	8.7	7.2	8.2	9.7	8.1	9.1
Annual Weeds			8.4			9.1
Sagebrush-grass	8.6	6.3	7.6	9.6	6.9	8.2
Grass	8.7	4.6	7.0	9.7	5.3	7.7
Pine			6.9			7.5
Juniper			6.6			7.3

1--Empty data entries represent types with only one site.

due to large variation in the dominant species (Table 7) which would allow for greater variation, therefore, the grass type was not included in the above distinctions. The range of the saltbush type and the sagebrush type overlap a great deal but the sagebrush type occurs at pH levels far lower than that of saltbush. Obviously, other factors are controlling which type occurs within the regions of overlap.

The only vegetation type within which there appears to be a relationship between pH and either percent cover or total production is the saltbush type and only for the production parameter. The total production of this type seems to vary indirectly with the pH of a saturated paste (Table 17). The range of pH in this type is alkaline and it should be expected that higher production would result under the more moderate conditions. The exception to this trend is the Sand Gulch study site which is probably due to a difference in the species composition of the understory (Table 2).

Organic Matter

The percentage of organic matter in the soil appears to have a relationship with the vegetative type that is found that is almost exactly opposite of that for pH (Table 18). While the highest pH levels occurred under the alkaline tolerant group, the lowest organic matter levels occur under the same group and the highest under the alkaline intolerant group. The obvious exception is the relatively high organic matter content of the soil under annual weeds which is probably due to the difference in life form, the annual form producing more biomass each year than the perennial form. In this case, as well as with pH, both the grass and sagebrush types have ranges that cover almost all of the other

Table 17. Comparison of pH of a saturated soil paste with total production for the saltbush vegetation type.

Study Site	pHs	Total Production (lbs/acre)
Halogeton #3 (Ridge)	7.9	512.33
Halogeton #2	8.1	555.13
Two Mile Hill	8.3	591.90
Halogeton #1 (East)	8.3	447.32
West Pasture	8.4	396.36
Burnt Wagon	8.4	280.78
Sand Gulch	8.7	717.01

Table 18. Comparison of the ranges[1] and means of organic matter content of the soil with the vegetative types occurring on it.

Vegetative Type	Number of Study Sites	Organic Matter (%)		
		High	Low	Mean
Annual Weeds	1			9.2
Juniper	1			4.8
Pine	1			3.0
Grass	4			1.8
Sagebrush-grass	23	4.9	.3	1.6
Greasewood	1	5.9	.5	.9
Saltbush	17			.8
Bud Sagewort	1	1.5	.2	.7
Hopsage	1			.5
Birdsfoot Sagewort	1			.2

1--Open data entries represent types with only one site.

types. For the grass type this can probably be attributed again to the wide variation in species composition and the corresponding variation in other factors. The same argument may be used for the understory of the sagebrush. Once again, the range of the saltbush type overlaps almost all of the other alkaline tolerant types but in this case does not overlap the means of any other types. Again, it should be stated that the variation in vegetation within areas of overlap is due to other factors.

The percentage of organic matter in the soil does not seem to be related to the percent cover of vegetation in any vegetative type. It does, however, appear to be related to production (Table 19). This is to be expected because sites with higher production must have more mulch which will eventually become incorporated into the soil. Variations in this trend probably are attributable to differences in decomposition rate.

Calcium Carbonate

The percentage of calcium carbonate in the soil seems to be related to the vegetative type that occurs on it (Table 20). There do not appear to be any distinct groups, as there were for pH, the means form a more continuous gradient from the greatest calcium carbonate content to the least. As with other factors, the range of the sagebrush grass type is quite wide and probably may be attributed to the broad ecological amplitude of sagebrush. The grass type also has a wide range which again probably can be attributed to the vide variation in species composition. The saltbush also has a rather wide range but, in this case, is completely enclosed by the range of the sagebrush type. Obviously, the type that occurs within this range is dependent upon other factors.

Table 19. Comparison of organic matter content of the soil with total production within the vegetative types.[1]

Vegetative Type - Study Site	Organic Matter (%)	Production (lbs/acre)
Sagebrush-grass		
Round Tip Mountain	2.5	708.58
North Butte	1.9	682.57
Buffalo Creek	1.6	698.75
Horse Creek (AGSP)	1.4	493.69
Bud Kimball	1.4	400.20
Horse Creek (AGSM)	1.3	541.14
Horse Creek (ARNO)	1.1	536.02
Cochran	1.0	495.89
Demer	1.0	435.87
Smilo	1.0	317.48
Saltbush		
Sand Gulch	1.5	717.01
Two Mile Hill	.9	591.90
Halogeton #3 (Ridge)	.9	512.33
Halogeton #2	.7	555.13
Burnt Wagon	.5	280.78
Halogeton #1 (East)	.4	447.32
West Pasture	.4	396.36

1--Only the sagebrush-grass and saltbush types are presented because other types do not have sufficient data to show trends.

Table 20. Comparison of the ranges[1] and means of percent calcium carbonate among vegetation types.

Vegetation Type	Percent $CaCO_3$		
	High	Low	Mean
Sagebrush-grass	34.6	.5	6.0
Birdsfoot sagewort			5.5
Saltbush	12.7	2.4	4.9
Greasewood			4.5
Bud Sagewort			3.8
Annual Weeds			3.2
Grass	8.3	.3	2.7
Hopsage			2.0
Juniper			1.7
Pine			1.3

1--Open data entries represent types with only one site.

The only type within which the percentage of calcium carbonate in the soil seems to have any relationship upon either production or percent cover is the saltbush type, and only on total production. The saltbush type appears to have higher levels of total annual production under conditions of relatively high or relatively low percent calcium carbonate and lower levels under relatively moderate percentages (Table 21).

Electrical Conductivity

The electrical conductivity of a soil paste extract appears to be related to the vegetation type that grows on it (Table 22). There seems to be two distinct groups of vegetation types based on electrical conductivity: a salt tolerant group (bud sagwort, annual weeds, and saltbush) and a salt intolerant group (all other types) within which there are rather continuous gradients that are not easily designated into groups. As with other factors, both the sagebrush-grass and saltbush vegetation types have wide ranges of occurrance with a large overlap. There are, however, areas where the two types do not overlap, saltbush has a higher maximum tolerance limit than sagebrush and sagebrush has a lower minimum tolerance limit than saltbush. The grass type has a rather narrow range within the center of the range of the sagebrush type. Once again, it must be stated that other factors must control the vegetation that occurs within areas of overlap.

The electrical conductivity also appears to be inversely related to percent vegetative cover within the grass vegetation type (Table 23). This relationship gives an indication that the grasses dominating this type are best adapted to low soil salt contents.

Table 21. Comparison of the percentage of calcium carbonate with total annual production for the saltbush vegetation type.

Study Site	$CaCO_3$ (%)	Total Production
Sand Gulch	12.7	717.01
Two Mile Hill	5.9	591.90
Halogeton #2	3.6	555.13
Burnt Wagon	3.3	280.78
West Pasture	3.0	396.36
Halogeton #3 (Ridge)	2.7	512.33
Halogeton #1 (East)	2.4	447.32

Table 22. Comparison of the ranges[1] and means of the electrical conductivity of a soil past extract among the vegetation types.

Vegetation Type	EC (mmhos)		
	High	Low	Mean
Bud Sagewort			4.31
Annual Weeds			4.00
Saltbush	11.08	.87	3.82
Birdsfoot Sagewort			1.23
Sagebrush-grass	6.78	.20	1.10
Grass	1.50	.41	.83
Greasewood			.81
Juniper			.51
Hopsage			.47
Pine			.33

1--Open data entries represent types with only one site.

Table 23. Comparison of the electrical conductivity of a soil past extract with percent vegetative cover for the grass vegetation type.

Study Site	EC	Percent Cover
Boysen	1.50	10.05
Lower Enos Creek	.86	13.73
Grass Creek Divide (Type B)	.53	13.69
Dutch Nick Flats	.41	18.53

Soil Moisture Relationships in Profile (Saran coated clods)

Neither the percent soil moisture capacity in the profile at 1/3 bar or 15 bars, nor the potential available moisture in the profile appear to have any relationship with vegetation type, percent cover, or total annual production at the sites studied.

Soil Moisture Relationships in Fines

Neither the percent soil moisture capacity in the fines at 1/3 bar or 15 bars nor the potential available moisture in the fines seem to be related to vegetation type, percent cover, or total annual production at the sites studied.

Soluble Cations

Of the four soluble cations tested, the content of only one, sodium, appears to have any relationship with the vegetation type (Table 24). The vegetation types separate nicely into two groups, one with relatively higher amounts of sodium (bud sagewort, annual weeds, and saltbush) and one with relatively lower amounts of sodium (all other types). Two vegetation types dominated by what are usually considered sodium tolerant species, greasewood and birdsfoot sagewort, are included in the low sodium group. The best explanation may be that the single site sampled for each is probably not representative of most soils under these types. Once again, the saltbush and sagebrush-grass types have wide ranges of tolerances that overlap, but not completely. The range of the grass type is relatively narrow and completely included in that of the sagebrush-grass type. Other factors must be controlling the vegetation that occurs within areas of overlap.

None of the tested soluble cations seemed to be related to either cover or production within any of the vegetation types.

Table 24. Comparison of the ranges[1] and means of the soluble sodium content among vegetation types.

Vegetation Type	Soluble Sodium (meq./100g)		
	High	Low	Mean
Bud Sagewort			1.6
Annual Weeds			1.4
Saltbush	4.3	.1	1.3
Birdsfoot Sagewort			.5
Sagebrush-grass	1.7	0	.4
Greasewood			.4
Juniper			.1
Hopsage			.1
Grass	.5	0	.1
Pine			0

1--Empty data entries represent vegetation types with only one site.

Exchangeable Cations

Two of the four exchangeable cations tested seemed to be related to vegetation type. The vegetation types, when arranged according to the content of exchangeable calcium in the soil on which they occur (Table 25), form a rather continuous gradient with the saltbush type at the high extreme and the annual weed type at the low extreme. The distribution of the vegetation types along this gradient does not seem to follow any groupings that have so far occurred. The ranges of the sagebrush-grass and saltbush types overlap relatively little.

If the vegetation types are arranged according to the content of exchangeable potassium in the soil on which they occur (Table 26), two groups form. One contains vegetation types dominated by the more salt tolerant species (bud sagewort, saltbush, annual weeds, birdsfoot sagewort, and greasewood) and the other contains vegetation types dominated by less salt tolerant species (grass, sagebrush-grass, pine, hopsage, and juniper). The range of the sagebrush-grass type is rather narrow and overlaps little with that of the saltbush type.

None of the exchangeable cations tested for appear to be related to either cover or production within any of the vegetation types.

Cation Exchange Capacity

The cation exchange capacity of the soil does not appear to be related to vegetative type, percent cover, or total annual production at the sites studied.

Gypsum

The gypsum content of the soil appears to be related to the vegetation type that occurs on it (Table 27). Three groups of vegetation types may

Table 25. Comparison of the ranges[1] and means of the exchangeable calcium content among vegetation types.

Vegetation Type	Exchangeable calcium (meg/100g)		
	High	Low	Mean
Saltbush	51.0	6.5	16.4
Pine			10.2
Bud Sagewort			9.0
Greasewood			7.4
Sagebrush-grass	12.7	3.7	7.1
Birdsfoot Sagewort			6.3
Grass	9.5	3.8	6.1
Hopsage			5.4
Juniper			5.4
Annual Weeds			4.6

1--Empty data entries represent types with only one site.

Table 26. Comparison of the ranges[1] and means of the exchangeable potassium content among vegetation types.

Vegetation Type	Exchangeable potassium (meg/100g)		
	High	Low	Mean
Bud Sagewort			7.5
Saltbush	21.9	.5	6.5
Annual Weeds			5.3
Birdsfoot Sagewort			4.5
Greasewood			4.4
Grass			1.9
Sagebrush-grass	6.6	.2	1.3
Pine	3.6	.2	.6
Hopsage			.4
Juniper			.4

1--Empty data entries represent types with only one site.

Table 27. Comparison of the ranges[1] and means of the gypsum content of the soil among the vegetation types.

Vegetation Type	Gypsum (meq/100g)		
	High	Low	Mean
Saltbush	39.6	0	8.1
Bud Sagewort			2.9
Grass	1.9	0	.5
Annual Weeds			0
Birdsfoot Sagewort			0
Greasewood			0
Hopsage			0
Juniper			0
Pine			0
Sagebrush-grass	0	0	0

1--Empty data entries represent types with only one site.

be defined on the basis of gypsum content: those occurring on relatively gypsiferous soils (saltbush), those occurring on soils with relatively low gypsum contents (bud sagewort and grass), and those occurring on soils with no gypsum (all other types). It is particularly interesting to note that all of the sites on which the sagebrush-grass type occurred were gypsum free.

Rooting Depth

The effective rooting depth does not appear to be related to vegetative type, production, or cover for those sites studied.

Soil Series at Multiple Sites

The interrelationships between soils and vegetation were considered only for one of the nine soil series found at multiple study sites because only two were found at more than three sites (Table 6) which is needed for a reasonable determination of trends. Of those two only the Mudray series occurred on more than three sites with vegetative data and even there only cover data was available. Within the Mudray series none of the soil chemical properties tested appeared to have any relationship with percent vegetative cover.

SUMMARY

1) Multiple Soil Series sites often exhibited dissimilar chemical characteristics.

2) Hi Silt = Hi Saltbush Production
Lo " = " " "
Medium " = Lo " "
No silt relationship with other types

3) Hi Bulk Density = Lo Vegetation Cover (Grass Type)
Lo " " = Hi " " " "
No Bulk Density relationship with other types

4) Hi " = Alkaline Tolerant Vegetation Types
Lo " = Non-alkaline " " "
Medium " = Grass-Type

5) Hi Saltbush Production = Lowest pH
Lo " " = Highest pH
No pH relationships with vegetation production in other types.

6) Sagebrush type pH overlaps saltbush type pH slightly

7) Grass type pH completely overlaps saltbush type pH

8) Alkaline tolerant types = Lo organic matter
" intolerant " = Hi " "

9) Hi organic matter = Hi vegetation production
Lo " " = Lo " "
No organic matter relationships with other types.

10) Hi calcium carbonate = Hi saltbush production
Lo " " = Hi " "
Medium " " = Lo " "
No calcium carbonate relationship with other types.

11) Hi electrical conductivity = salt tolerant vegetation type groups
Lo " " = " intolerant " " "

12) Saltbush electrical conductivity tolerance highest
Sagebrush " " " lowest
Grass " " " occurance intermediate

13) Grass type
Hi electrical conductivity = Lo vegetation cover
Lo " " = Hi " "

14) Available moisture in profile has no relationship with vegetation type. Available moisture in fines has no relationship with vegetative type.

15) Available soil moisture is of little value
A) Soils seldom saturated thus 1/3 bar measurement does not relate to native situation.
B) 15 bars is an insignificant extraction level for most native species since most achieve levels many times greater.

16) Hi soluble sodium = sodium tolerant group
Lo " " = " intolerant "
Other soluble cations exhibit no relationship with vegetation types.

17) Exchangeable cations related to vegetation type: calcium and potassium.
Exchangeable cations not related to vegetation type: sodium and magnesium.
Insolubility of exchangeable cations causes functional differences.

18) No Cation Exchange Capacity relationships with vegetation types.

19) Hi gypsum = saltbush vegetation types
Moderate to Low gypsum = bud sagewort and grass vegetation types.

No Gypsum = sagebrush and all other vegetation types.

20) Effective rooting depth not related to vegetation type, production or cover

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APPENDIX A

SOIL PROFILE DESCRIPTIONS

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PERSAYO very fine sandy loam (Basin Flats exclosure, Big Sagebrush site)
Soil Family: Typic Torriorthents, loamy, mixed (calcareous), mesic, shallow.
Location: Basin Flats exclosure, Big Horn County; NW¼, NE¼, Sec. 15, T.50N., R.92W.
Climate: Eight-year average annual precipitation is 6.20 inches. Mean annual soil temperature is about 51°F. Frost-free season is over 120 days. Elevation is 4,250 feet.
Vegetation and Use: Big sagebrush, Gardner saltbush, cactus, Sandberg bluegrass; used for grazing.
Parent Material: Residuum from soft sandstone.
Physiography: Rolling hillside.
Drainage: Well to excessively drained.
Moisture: Dry to 20 inches.
Groundwater: None.
Erosion: Moderate.
Permeability: Moderate.
Sampled by: H. Fisser, L. Young, C. McAfee, and J. Stephens.
Described by: J. R. Stephens; 7/14/77.
(Colors are for air-dry soil unless otherwise noted.)

A11 0 to 10 cm. (0 to 4 inches); Yellowish brown (10YR 5/4) very fine sandy loam, olive brown (2.5Y 4/4) moist; weak fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; many fine medium and coarse roots; moderate effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

A12 10 to 20 cm. (4 to 8 inches); Yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; few medium and coarse roots; moderate effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

C1 20 to 41 cm. (8 to 16 inches); Light olive brown (2.5Y 5/4) very fine sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few coarse roots; contains few coarse (2 to 3 cm. in width) calcium carbonate filled channels extending diagonally through horizon; 15 to 25 percent thin sandstone platelets 1/4 to 1/2 inch size; moderate effervescence; strongly alkaline (pH 8.8); gradual wavy boundary.

Cr 41 cm. (16 inches); Soft, platy, calcareous sandstone.

MUDRAY sandy loam variant (Basin Flats exclosure, Salt Bush site)
Soil Family: Typic Natrargids, clayey, montmorillonitic, mesic, shallow.
Location: Basin Flats exclosure, Big Horn County; NW¼, NE¼, Sec. 15, T.50N., R.92W.
Climate: Eight-year average annual precipitation is 6.20 inches. Mean annual soil temperature is about 51°F. Frost-free season is over 120 days. Elevation is 4,250 feet.
Vegetation and Use: Gardner saltbush, Sandberg bluegrass; used for grazing.
Parent Material: Residuum from gypsiferous shale.
Physiography: Upland ridge and hillside.
Drainage: Well drained.
Moisture: Dry to over 30 inches when described.
Groundwater: None within 5 feet.
Erosion: Moderate to severe.
Permeability: Slow.
Sampled by: H. Fisser, L. Young, C. McAfee, and J. Stephens.
Described by: J. R. Stephens; 7/14/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 15 cm. (0 to 6 inches); Pale brown (10YR 6/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak thick platy parting to weak medium and coarse subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; many fine and medium roots; moderate effervescence; strongly alkaline (pH 8.6); abrupt smooth boundary. (Thickness varies from 2 to 8 inches)

B21tcacs 15 to 36 cm. (6 to 14 inches); Brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate fine and medium prismatic structure parting to moderate fine and medium angular blocky; extremely hard, very firm, sticky, plastic; few fine and medium roots; common moderately thick waxy coatings on faces of peds; few fine seams and soft masses of calcium carbonate; few medium soft masses of calcium sulfate; moderate effervescence; very strongly alkaline (pH 9.2); clear smooth boundary.

B3tcacs 36 to 51 cm. (14 to 20 inches); Light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium angular blocky structure; hard, firm, sticky, plastic; very few medium roots; few thin waxy coatings on faces of peds; many medium and coarse soft masses of calcium sulfate, few fine and medium seams and soft masses of calcium carbonate; moderate effervescence; moderately alkaline (pH 8.2); gradual wavy boundary.

Cr 51 cm. (20 inches); Soft, dark gray, weakly calcareous shale with many coarse soft masses of calcium sulfate.

Fort Collins loam, dry phase. (Big Bend Exclosure).
Taxonomic Classification: Fine-loamy, mixed, mesic Ustollic Haplargids.
Location: Big Bend exclosure; Hot Springs County, Wyoming; NE1/4, SW1/4, Sec. 6, T.43N., R.90W.
Climate: Annual precipitation is 10.03 inches, based on 10 years' data. Mean annual soil temperature is about 51°F.; frost-free season is about 120 days. Elevation is 4,700 feet.
Vegetation and Land Use: Big sagebrush, western wheatgrass, Sandberg bluegrass; used for grazing.
Parent Material: Alluvial fan and slopewash materials.
Physiography: Gently sloping alluvial fan.
Drainage: Well drained.
Moisture: Profile was dry to 38 inches and moist from 38 to 60 inches when described.
Groundwater: More than 5 feet.
Erosion: Slight.
Permeability: Moderate.
Sampled By: H. Fisser, D. Trueblood, D. Samuelson, J. Stephens.
Described By: J. Stephens, D. Trueblood; 8-7-78.
(Colors are for air-dry soil unless otherwise noted).

A1 0 to 7 cm. (0 to 3 inches) Grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; slightly hard, friable, sticky, plastic; many fine and medium roots; neutral (pH 7.2); clear smooth boundary.

B21t 7 to 15 cm. (3 to 7 inches) Brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; hard, firm, sticky, plastic; many medium and few coarse roots; few thin patchy clay films on faces of peds; neutral (pH 7.2); clear smooth boundary.

B22t 15 to 28 cm. (7 to 11 inches) Grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, firm, sticky, plastic; few medium coarse roots; thin nearly continuous clay films on faces of peds; mildly alkaline (pH 7.4); gradual wavy boundary.

B3tca 28 to 56 cm. (11 to 22 inches) Brown (10YR 5/3) clay loam, olive brown (2.5YR 4/4) moist; moderate medium angular blocky structure; hard, firm, sticky, plastic; very few medium and coarse roots; common thin clay films; many medium soft masses of calcium carbonate; violent effervescence; strongly alkaline (pH 8.6); gradual wavy boundary.

C1ca 56 to 96 cm. (22 to 38 inches) Light brownish gray (2.5Y 6/2) light clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; occasional coarse roots; many

medium and large soft masses of calcium carbonate; violent effervescence; strongly alkaline (pH 8.8); gradual wavy boundary.

C2ca 96 to 153 cm. (38 to 60 inches) Light brownish gray (2.5Y 6/2) heavy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common medium and large soft masses of calcium carbonate; violent effervescence; strongly alkaline (pH 9.0).

BINTON loam (Big Flat exclosure)
Soil Family: Typic Torrifluvents, fine-loamy, mixed (calcareous), mesic.
Location: Big Flat exclosure, Big Horn County; NE¼, NW¼, Sec. 20, T.50N., R.92W.
Climate: Seven-year average annual precipitation is 5.8 inches. Mean annual soil temperature is about 51°F. Frost-free season is over 120 days. Elevation is 4,200 feet.
Vegetation and Use: Gardner saltbush; used for grazing.
Parent Material: Alluvium from loamstone.
Physiography: Alluvial basin, nearly level.
Drainage: Well to imperfectly drained.
Moisture: Profile was dry to 60 inches when described.
Groundwater: None within 5 feet.
Erosion: Slight to moderate.
Permeability: Moderately slow.
Sampled by: H. Fisser, L. Young, C. McAfee, and J. Stephens.
Described by: J. R. Stephens; 7/13/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 10 cm. (0 to 4 inches); Light gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine medium and coarse roots; moderate effervescence; moderately alkaline (pH 8.2); clear smooth boundary.

C1ca 10 to 31 cm. (4 to 12 inches); Brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky, plastic; few fine medium and coarse roots; few coarse seams of calcium carbonate and soft masses of salts; moderate effervescence; very strongly alkaline (pH 9.0); clear smooth boundary.

C2ca 31 to 51 cm. (12 to 20 inches); Brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; hard, firm, sticky, plastic; few coarse roots; common fine seams of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.2); clear smooth boundary.

C3ca 51 to 81 cm. (20 to 32 inches); Light olive brown (2.5YR 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; common fine threads of calcium carbonate; few fine specks of salts; violent effervescence; strongly alkaline (pH 8.8); clear smooth boundary.

IICca 81 to 114 cm. (32 to 45 inches); Light olive brown (2.5Y 5/4) heavy sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few fine seams of calcium carbonate; moderate effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

IIC 114 to 152 cm. (45 to 60 inches); Light yellowish brown (2.5Y 6/4) coarse sandy loam, olive brown (2.5Y 4/4); single grained; soft, very friable, nonsticky, nonplastic; moderate effervescence; moderately alkaline (pH 8.4).

NANNYTON fine sandy loam (Big Sage exclosure)
Soil Family: Typic Haplargids, fine-loamy, mixed, mesic.
Location: Big Sage exclosure, Park County; NW¼, SW¼, Sec. 30, T53N., R.100W.
Climate: Annual precipitation is 7.5 inches (7-year average). Mean annual soil temperature is about 50°F. Frost-free season is over 110 days. Elevation is 5,070 feet.
Vegetation and Use: Big sagebrush, bluebunch wheatgrass, threadleaf sedge, blue grama; use is grazing in the area outside the exclosure.
Parent Material: Alluvium from old outwash materials.
Physiography: Gently sloping terrace remnant.
Drainage: Well drained.
Moisture: Profile was dry to 60 inches.
Groundwater: None within 5 feet.
Erosion: Slight.
Permeability: Moderate.
Sampled by: L. Young, H. Fisser, C. McAfee, J. Stephens, D. Viktorin.
Described by: J. R. Stephens; 7/12/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 7.5 cm. (0 to 3 inches); Pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate medium and coarse granular structure; soft, very friable, nonsticky, nonplastic; many fine and medium roots; 5 percent gravel; mildly alkaline (pH 7.4); clear smooth boundary.

B21t 7.5 to 23 cm. (3 to 9 inches); Brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, friable, slightly sticky, slightly plastic; few fine medium and coarse roots; common thin clay films on faces of peds; 5 percent gravel; mildly alkaline (pH 7.6); clear smooth boundary.

B22t 23 to 36 cm. (9 to 14 inches); Light brownish gray (10YR 6/2) sandy clay loam, dark brown (10YR 4/3) moist; moderate fine and medium angular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few coarse roots; few thin patchy clay films on faces of peds; few fine and medium threads of calcium carbonate; 10 to 15 percent 1/2- to 1-inch gravel; moderate effervescence; strongly alkaline (pH 8.6); gradual wavy boundary.

B3tca 36 to 48 cm. (14 to 19 inches); Pale brown (10YR 6/3) with white (10YR 8/2) calcium carbonate masses, gravelly loam, grayish brown (10YR 5/2) moist; weak medium angular blocky structure; extremely hard, friable, slightly sticky, slightly plastic; few coarse roots; few thin clay films in root channels; many medium and coarse seams and soft masses of calcium carbonate; 20 to 25 percent 1/2- to 1-inch gravel; violent effervescence; strongly alkaline (pH 8.8); clear smooth boundary.

C1ca 48 to 84 cm. (19 to 33 inches); Pale brown (10YR 6/3) with white (10YR 8/2) calcium carbonate seams, gravelly loam, dark brown (10YR 4/3) moist; massive; extremely hard, friable, slightly sticky, slightly plastic; many medium and coarse seams of calcium carbonate; 20 to 25 percent 1/2- to 1-inch gravel; violent effervescence; very strongly alkaline (pH 9.0); gradual wavy boundary.

C2ca 84 to 152 cm. (33 to 60 inches); Light brownish gray (10YR 6/2) heavy sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few fine and medium seams of calcium carbonate; 15 percent gravel; violent effervescence; very strongly alkaline (pH 9.0).

TOLUCA fine sandy loam variant (Big Sky exclosure)
Soil Family: Ustollic Haplargids, fine-loamy, mixed, mesic.
Location: Big Sky exclosure, Park County; NE¼, NE¼, Sec. 29, T.53N., R.100W.
Climate: Annual precipitation is about 10 inches. Mean annual soil temperature is about 50°F. Frost-free season is over 110 days. Elevation is 5,330 feet.
Vegetation and Use: Big sagebrush, bluebunch wheatgrass, needleandthread, western wheatgrass; used for grazing.
Parent Material: Loamy-gravelly outwash terrace materials.
Physiography: Rolling terraces.
Drainage: Well drained.
Moisture: Profile was dry to 60 inches.
Groundwater: None within 5 feet.
Erosion: Slight.
Permeability: Moderate.
Sampled by: H. Fisser, L. Young, C. McAfee, D. Viktorin, J. Stephens.
Described by: J. R. Stephens; 7/12/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 7.5 cm. (0 to 3 inches); Dark brown (10YR 4/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine and medium roots; mildly alkaline (pH 7.4); clear smooth boundary.

B2t 7.5 to 28 cm. (3 to 11 inches); Brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium and coarse angular blocky; slightly hard, friable, slightly sticky, slightly plastic; few fine and medium roots; few thin clay films on faces of peds; 5 to 10 percent gravel; mildly alkaline (pH 7.6); gradual wavy boundary.

B3tca 28 to 43 cm. (11 to 17 inches); Pale brown (10YR 6/3) with white (10YR 8/2) seams of calcium carbonate, loam, dark brown (10YR 4/3) moist; weak medium angular blocky structure; hard, friable, slightly sticky, slightly plastic; very few medium roots; few thin glossy coatings on faces of peds; many fine and medium seams of calcium carbonate; 10 to 20 percent gravel; moderate effervescence; strongly alkaline (pH 8.6); clear smooth boundary.

C1ca 43 to 63 cm. (17 to 25 inches); Very pale brown (10YR 7/3) loam with white (10YR 8/2) calcium carbonate seams, pale brown (10YR 6/3) moist; massive; hard, friable, slightly sticky, slightly plastic; many medium and coarse seams of calcium carbonate; 10 to 20 percent gravel; violent effervescence; very strongly alkaline (pH 9.0); clear smooth boundary.

C2ca 63 to 84 cm. (25 to 34 inches); Light gray (10YR 7/2) gravelly loam, pale brown (10YR 6/3) moist; massive; hard, friable, slightly sticky, slightly plastic; fine disseminated calcium carbonate; 20 to 30 percent gravel; violent effervescence; very strongly alkaline (pH 9.0); gradual wavy boundary.

C3ca 84 to 152 cm. (34 to 60 inches); Pale brown (10YR 6/3) gravelly sandy clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; fine disseminated calcium carbonate; 20 to 30 percent gravel, 5 to 10 percent cobble; violent effervescence; very strongly alkaline (pH 9.0).

GARLAND sandy loam (Boysen exclosure)
Soil Family: Typic Haplargids, fine-loamy over sandy or sandy-skeletal, mixed, mesic.
Location: Boysen exclosure, Fremont County; NE¼, NE¼, Sec. 21, T.39N., R.94W.
Climate: Mean annual precipitation is 4.89 inches based on 15-years' data. Mean annual soil temperature is about 53°F. Frost-free season is over 120 days. Elevation is 4,825 feet.
Vegetation and Use: Blue grama; use is grazing.
Parent Material: Outwash alluvium.
Physiography: Alluvial fan, nearly level.
Drainage: Well drained.
Moisture: Profile was dry to 32 inches and wet below 32 inches due to moisture trapped in old pit.
Groundwater: More than 5 feet.
Erosion: Slight.
Permeability: Moderate.
Sampled by: H. Fisser, J. Stephens, L. Young, K. Spaeth, and J. Orpet.
Described by: J. R. Stephens; 6/2/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 10 cm. (0 to 4 inches); Light brownish gray (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; loose, very friable, nonsticky, nonplastic; many fine and medium and few coarse roots; moderate effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

B21t 10 to 25 cm. (4 to 10 inches); Brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic parting to weak fine and medium angular blocky structure; hard, firm, sticky, plastic; many fine and medium and few coarse roots; few thin clay films on faces of peds; violent effervescence; strongly alkaline (pH 8.8); clear smooth boundary.

B22tca 25 to 43 cm. (10 to 17 inches); Brown (10YR 5/3) light sandy clay loam, dark brown (10YR 4/3) weak medium prismatic parting to moderate medium angular blocky structure; extremely hard, firm, sticky, plastic; few medium and coarse roots; few thin patchy clay films on faces of peds; many coarse soft masses of calcium carbonate; violent effervescence; strongly alkaline (pH 8.8); clear wavy boundary.

B3tca 43 to 58 cm. (17 to 23 inches); Brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak medium angular blocky structure; extremely hard, friable, slightly sticky, slightly plastic; few medium roots; few thin patchy clay films on faces of peds; many coarse soft masses of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.4); clear wavy boundary.

Cca 58 to 81 cm. (23 to 32 inches); Yellowish brown (10YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; massive; hard, firm, sticky, plastic; very few medium roots; many fine specks and threads of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.4); clear wavy boundary.

C 81 cm. (32 inches); Yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown; massive; loose, nonsticky, nonplastic; 50 percent 1/2- to 3-inch rounded lime coated gravel; violent effervescence; moderately alkaline (pH 8.2).

ULM loam, dry variant (Bud Kimball exclosure)
Soil Family: Ustollic Haplargids, bine, montmorillinitic, mesic
Location: Bud Kimball exclosure, Washakie county, NE¼, NW¼, Sec. 28, T46N, R86W
Climate: Annual precipitation is 8 to 13 inches. Mean annual soil temperature is 47 to 50°F. Frost-free season is 110 to 120 days.
Vegetation and land use: Big sagebrush, western wheatgrass; grazing.
Parent Material: Moderately fine, textured calcareous sediments from alkaline shales.
Physiolgraphy: Upland slopes, 3 to 10 percent.
Drainage: Well drained.
Permeability: Moderately slow.
Described by: C. Fowkes, 1971

A11 0-2"; Pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 3/3) moist; weak fine platy parting to moderate very fine granular structure; soft, very friable, non-sticky, non-plastic; thin vesicular crust; calcareous; mildly alkaline, pH 7.4 (P.R.); abrupt smooth boundry.

A12 2-5"; Brown (10YR 5/3) loam, dark brown (10YR 3/3) mosit; weak fine platy structure; soft, very friable, slightly sticky, plastic; many micro and fine, common medium and coarse roots; noncalcareous; mildly alkaline, pH 7.6 (P.R.); abrupt smooth boundary.

B1 5-8"; Brown (10YR 5/3) loam dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, non-sticky, non-plastic; many micro and fine, common medium and coarse roots; common micro and fine pores; noncalcareous; moderately alkaline, pH 8.0 (T.B.); abrupt smooth boundary.

B2t 8-13"; Brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) moist; strong fine prismatic parting to strong fine angular blocky structure; very hard, firm, sticky, plastic; few micro and fine, very few medium and coarse roots; common micro and fine pores; thin continuous and thick patches of glossy coatings on all ped faces; noncalcareous; strongly alkaline, pH 8.4 (T.B.); clear wavy boundary.

B2tca 13-16"; Brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate fine prismatic parting to moderate fine angular blocky structure; hard, firm, sticky, plastic; few micro and fine roots; common micro and fine pores; thin glossy coatings in root channels; calcareous; common fine threads and seams of clacium carbonate; strongly alkaline, pH 8.6 (T.B.); clear wavy boundary.

B3ca 16-27"; Light gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) moist; weak medium and fine angular blocky structure; slightly hard, friable, sticky, plastic; few micro and fine roots to 23 inches; common micro and fime pores; calcareous; calcium carbonate is disseminated; strongly alkaline, pH 8.9 (T.B.); gradual wavy boundary.

Cca 27-40"; Light gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; slightly hard, friable, sticky, plastic; common micro and fine pores; calcareous; few to common fine seams and threads of calcium carbonate; strongly alkaline, pH 9.0 (T.B.).

Remarks: Cooperative range-soil study with Range Department of University of Wyoming. This pedon was described at the Bud Kimball exclosure.

McCREA loam (Buffalo Basin exclosure)
Soil Family: Ustollic Camborthids, fine-loamy, mixed, mesic.
Location: Buffalo Basin exclosure, Park County; NW¼, NE¼, Sec. 3, T.47N., R.100W.
Climate: Mean annual precipitation is 10.77 inches based on 8-years' data. Mean annual soil temperature is about 49° or 50° F. Frost-free season is 100 to 140 days. Elevation is 6,000 feet.
Vegetation and Use: Big sagebrush, prairie junegrass; used for grazing in the area outside the exclosure.
Parent Material: Local alluvium derived from slopewash from soils forming on loamstone.
Physiography: Nearly level alluvial fan.
Drainage: Well drained.
Moisture: Profile was moist to 33 inches when described.
Groundwater: More than 5 feet, no evidence of any groundwater.
Erosion: Slight.
Permeability: Moderate.
Sampled by: J. Stephens, K. Spaeth, L. Young, and J. Orpet.
Described by: J. R. Stephens; 6/3/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 13 cm. (0 to 5 inches); Light brownish gray (10YR 6/2) heavy loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium and few coarse roots; mildly alkaline (pH 7.4); clear smooth boundary.

B2 13 to 30 cm. (5 to 12 inches); Grayish brown (10YR 5/2) light clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium and coarse angular blocky; very hard, firm, sticky, plastic; few fine and common medium and coarse roots; moderately alkaline (pH 8.0); clear smooth boundary.

B2ca 30 to 48 cm. (12 to 19 inches); Pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak coarse angular blocky structure; hard, firm, slightly sticky, slightly plastic; few medium and coarse roots; many fine distinct specks of calcium carbonate; moderate effervescence; strongly alkaline (pH 8.6); clear smooth boundary.

C1ca 48 to 86 cm. (19 to 34 inches); Pale brown (10YR 6/3) loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; very few coarse roots to 24 inches; many fine distinct specks of calcium carbonate; violent effervescence; strongly alkaline (pH 8.6); clear smooth boundary.

C2ca 86 to 152 cm. (34 to 60 inches); Pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few fine distinct threads of calcium carbonate; violent effervescence; strongly alkaline (pH 8.6).

FORT COLLINS very fine sandy loan, dry variant (Buffalo Creek exclosure)
Soil Family: Ustollic Haplargids, fine-loamy, mixed, mesic
Location: Buffalo Creek exclosure, Washakie county, SW¼, NW¼, Sec. 1, T 43N, 89W
Climate: Annual precipitation is 8 to 13 inches. Mean annual soil temperature is 47 to 50°F. Frostfree season is 110 to 120 days.
Vegetation and Land Use: big sagebrush, bluebunch wheatgrass; grazing
Parent Material: medium textured calcareous alluvium
Physiography: alluvial fans, slopes 0 to 10 percent
Drainage: well drained
Permeability: moderate
Described by: C. Fowkes, 1971

A1 0-2"; Light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine platey parting to weak fine granular structure; soft, very friable, nonsticky, nonplastic; many micro, very fine, and fine roots; vesicular crust; noncalcareous; mildly alkaline, pH 7.6 (P.R.); abrupt smooth boundary.

B1 2-5" Dark grayish brown clay loam, very dark grayish brown moist; weak medium platey parting to moderate medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common micro, very fine, and fine roots; common fine pores; thin patchy glossy coatings on ped faces; non-calcareous; moderately alkaline, pH 7.8 (P.R.); abrupt smooth boundary.

B2t 5-13" Dark grayish brown (10YR 4/2) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic parting to moderate medium subangular blocky structure; very hard, firm, sticky, plastic; common micro, very fine, and fine, few medium and coarse roots; common fine pores; thin patchy glossy coatings on ped faces; noncalcareous; moderately alkaline, pH 7.8 (P.R.); clear wavy boundary.

B3ca 13-19" Light gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium and fine subangular blocky structure; hard, firm, sticky, plastic; few fine, medium, and coarse roots; few fine pores; calcareous; many medium and coarse soft concretions and seams of calcium carbonate; moderately alkaline, pH 8.0 (T.B.); gradual wavy boundary.

C1ca 19-32" Light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak coarse and medium subangular blocky structure; hard, firm, sticky, plastic; very few fine pores; calcareous; many coarse and common nedium soft concretions seams and streaks of calcium carbonate; strongly alkaline, pH 8.9 (T.B.); gradual wavy boundary.

C2 32-40" Light gray (2.5Y 7/2) grayish brown (2.5Y 5/2) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; calcareous; few fine seams of calcium carbonate; strongly alkaline, pH 9.0 (T.B.).

Remarks: Cooperative range-soil study with Range Department of University of Wyoming. This pedon was described at the Buffalo Creek exclosure.

MUDRAY fine sandy loam, brown variant (Burnt Wagon exclosure)
Soil Family: Typic Natrargids, clayey, montmorillonitic, mesic, shallow.
Location: Burnt Wagon exclosure, Washakie County; NE¼, NE¼, Sec. 4, T.48N., R.95W.
Climate: Mean annual precipitation is 5.97 inches based on 13-years' data. Mean annual soil temperature is from 47° to 52°F. Frost-free season is 120 to 150 days. Elevation is 4,520 feet.
Vegetation and Land Use: Gardner saltbush; used for grazing.
Parent Material: Residuum from shale.
Physiography: Rolling uplands.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None.
Erosion: Slight.
Permeability: Slow.
Sampled by: H. Fisser, J. Stephens, J. Orpet, K. Spaeth, D. Viktorin; 5/31/77.
Described by: J. R. Stephens; 5/31/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 2.5 cm. (0 to 1 inch); Light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium granular structure; soft, friable, slightly sticky, slightly plastic; few medium and coarse roots; moderate effervescence; moderately alkaline (8.2); abrupt smooth boundary.

B21t 2.5 to 10 cm. (1 to 4 inches); Brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; weak medium columns parting to weak medium angular blocky structure; extremely hard, very firm, sticky, plastic; few thin patchy clay films on faces of peds; few medium and coarse roots; moderate effervescence; very strongly alkaline (pH 9.4); clear smooth boundary.

B22t 10 to 25 cm. (4 to 10 inches); Yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; weak medium angular blocky structure; extremely hard, very firm, sticky, plastic; few medium and coarse roots; many thin patchy clay films on faces of peds; moderate effervescence; very strongly alkaline (pH 9.2); clear smooth boundary.

C1 25 to 43 cm. (10 to 17 inches); Brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; massive; slightly hard, firm, sticky, plastic; few coarse roots; 25 to 30 percent 1/8- to 1/4-inch light gray shale platelets; moderate effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

Cr 43 cm. (17 inches); Light gray, calcareous, platy shale.

MUDRAY loam (Chalk exclosure)
Soil Family: Typic Natrargids, clayey, montmorillonitic, mesic, shallow.
Location: Chalk exclosure, Washakie County; SE¼, NE¼, Sec. 22, T.48N., R.95W.
Climate: Annual precipitation is 5 to 7 inches. Fourteen-year mean annual precipitation is 6.13 inches. Mean annual soil temperature is about 51°F. Frost-free season is 120 to 150 days. Elevation is 4,460 feet.
Vegetation and Land Use: Birdfoot sagebrush; grazing, native range.
Parent Material: Formed in residuum from interbedded sandstone and alkaline shale.
Physiography: Upland ridges and sideslopes.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None, more than 5 feet.
Erosion: Slight to moderate.
Permeability: Slow to very slow.
Sampled by: H. Fisser, J. Orpet, K. Spaeth, D. Viktorin, J. Stephens.
Described by: J. R. Stephens; 5/31/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 1.5 cm. 0 to 1/2 inch); Pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; porous crust; slightly hard, friable, nonsticky, nonplastic; few medium roots; slight effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

A2 1.5 to 5 cm. (1/2 to 2 inches); Brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse porous subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; few medium roots; moderate effervescence; strongly alkaline (pH 9.0); abrupt smooth boundary.

B21t 5 to 13 cm. (2 to 5 inches); Brown (7.5YR 5/4) heavy clay loam, dark brown (7.5YR 4/4) moist; weak medium angular blocky structure; hard, firm, sticky, plastic; few thin patchy clay films on faces of peds; few medium roots; strong effervescence; very strongly alkaline (pH 9.4) gradual wavy boundary.

B3tca 13 to 25 cm. (5 to 10 inches); Brown (10YR 5/4) with mottles of pinkish white (7.5YR 8/2) heavy clay loam, dark brown (7.5YR 4/4) moist; weak medium angular blocky structure; hard, firm, sticky, plastic; few thin patchy clay films on faces of peds; few fine specks of calcium carbonate; very few medium and coarse roots; strong effervescence; very strongly alkaline (pH 9.4); gradual wavy boundary.

Cr 25 cm. (10 inches); Interbedded sandstone and alkaline shale.

ULM very fine sandy loam, dry variant (Cochran exclosure)
Soil Family: Ustollic Haplargids, fine, montmosillonitic, mesic
Location: Cochran exclosure, Hot Springs county, NE¼, NW¼, Sec. 17, T43N, R93W
Climate: Annual precipitation is 8 to 13 inches. Mean annual soil temperature is 47 to 50°F. Frost-free season is 110 to 120 days.
Vegetation and Land Use: big sagebrush, western wheatgrass; grazing
Parent Material: medium to moderately fine textured calcareous sediments from interbedded sandstome and alkaline shales.
Physiography: upland slopes, 3 to 10 percent
Drainage: well drained
Permeability: moderately slow
Described by: C. Fowkes, 1971

A11 0-2" Brown (10YR 5/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable, nonsticky, nonplastic; many micro and fine, common coarse and medium roots; noncalcareous; mildly alkaline, pH 7.6 (P.R.); abrupt smooth boundary.

A12 2-5" Grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine platey structure; soft, very friable, nonsticky, nonplastic; many micro and fine, common medium and coarse roots; many fine, common medium pores; noncalcareous; moderately alkaline pH 8.0 (T.B.; abrupt smooth boundary.

B2t 5-10" Brown (7.5YR 5/2) clay loam, dark brown (7.5 YR 4/2) moist; moderate medium prosmatic parting to strong fine angular blocky structure; very hard, firm, sticky, plastic; common roots all sizes; few fine pores; thin continuous and moderately thick patches of glossy coatings on all ped faces; noncalcareous; moderately alkaline, pH 8.1 (T.B.); clear wavy boundary.

B3ca 10-18" Pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak medium prismatic parting to moderate medium and fine angular blocky structure; hard, friable, sticky, plastic, few fine roots; common fine pores; thin patchy glossy coatings on all ped faces; calcareous; common fine and medium soft concretions, seams, and threads of calcium carbonate; strongly alkaline, pH 8.4 (T.B.); gradual wavy boundary.

C1ca 18-33" Light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak coarse and medium subangular blocky structure; slightly hard, very friable, slightly sticky, plastic; common fine, few medium and coarse pores; calcareous; many fine soft concretions and seams of calcium carbonate; strongly alkaline, pH 8.7 (T.B.); gradual wavy boundary.

C2 33-40" Light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; massive; slighly hard, very friable, slightly sticky, plastic; common fine pores; calcareous; few fine soft concretions of calcium carbonate; very strongly alkaline, pH 9.2 (T.B.).

Remarks: Cooperative range-soil study with Range Department of University of Wyoming. This pedon was described at the Cochran exclosure.

GRIFFY fine sandy loam, thin solum variant (Demer exclosure)
Soil Family: Typic Haplargids, fine-loamy, mixed, mesic
Location: Demer exclosure, Washakie county, NE¼, NW¼, Sec. 18, T45N, R91W.
Climate: Annual precipitation is 5 to 9 inches. Mean annual soil temperature is 49 to 52°F. Frost-free season 110 to 130 days.
Vegetation and Land Use: big sagebrush, blue grama,,; grazing
Parent Material: moderately sandy calcareous alluvium
Physiography: alluvial fans and terraces, slopes 0 to 10 percent
Drainage: well drained
Permeability: moderate
Described by: C. Fowkes, 1971

A1 0-2" Pale brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine platey structure; soft, very friable, nonsticky, nonplastic; many micro, very fine, and fine, very few medium and coarse roots; noncalcareous; moderately alkaline, pH 8.0 (T.B.); abrupt smooth boundary.

B2t 2-7" Pale brown (10YR 6/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prosmatic parting to moderate medium subangular blocky structure: hard, firm, sticky, plastic; common micro, very fine and fine, few medium and coarse roots; thin nearly continuous clay film on all ped faces; noncalcareous; moderately alkaline, pH 8.4 (T.B.); clear wavy boundary.

B3ca 7-12" Light gray (10YR 7/2) sandy clay loam, grayish brown (10YR 5/2) moist; weak coarse and medium subangular blocky structure; hard, friable, sticky, plastic; common micro, very fine, and fine, few medium and coarse roots; common micro, very fine and fine pores; thin patchy coatings on all ped faces; calcareous, common medium soft concretions streaks and seams of calcium carbonate; strongly alkaline, pH 8.6 (T.B.); gradual wavy boundary.

C1ca 12-23" Light gray (10YR 7/2) sandy loam, grayish brown (qoYR 5/2) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common micro, very fine, and fine, few medium and coarse roots; common fine pores; calcareous; many coarse to fine soft concretions and seams of calcium carbonate; strongly alkaline, pH 8.9 (T.B.); gradual wavy boundary.

C2 23-32" Light gray (10YR 7/2) sandy loam, grayish brown (10YR 5/2) moist; massive, slightly hard, friable, slightly sticky, slightly plastic; few fine roots; calcareous; strongly alkaline, pH 9.0 (T.B.); gradual wavy boundary.

C3 32-40" Light gray (10YR 7/2) sandy loam grayish brown (10YR 5/2) moist; single grained; slightly hard, very friable, nonsticky, nonplastic; calcareous; moderately alkaline, pH 8.0 (T.B.).

Remarks: Cooperative range-soil study with Range Department of University of Wyoming. This pedon was described at the Demer exclosure.

PERSAYO loam variant (East Ridge exclosure, Big Sage site)
Soil Family: Lithic Torriorthents, loamy, mixed (calcareous), mesic
Location: East Ridge exclosure, Washakie County; SE¼, NW¼, Sec. 33, T.48N., R.97W.
Climate: Annual precipitation is 5 to 7 inches. Mean annual soil temperature is about 51°F. Frost-free season is over 120 days. Elevation is 5,550 feet.
Vegetation and Land Use: Big sagebrush, Sandberg bluegrass, bottlebrush squirreltail; use is grazing.
Parent Material: Hard, slabby sandstone.
Physiography: Upland ridge crests and hillsides.
Drainage: Well drained.
Moisture: Profile was moist to 6 inches when described.
Groundwater: None.
Erosion: Slight.
Permeability: Moderate.
Sampled by: H. Fisser, J. Stephens, L. Young, J. Orpet, K. Spaeth, D. Viktorin.
Described by: J. R. Stephens; 6/1/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 5 cm. (0 to 2 inches); Brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate fine and medium granular structure; soft, friable, slightly sticky, slightly plastic; many fine and few coarse roots; mildly alkaline (pH 7.4); clear smooth boundary.

C1 5 to 20 cm. (2 to 8 inches); Brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium angular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many coarse and few fine roots; weak effervescence; mildly alkaline (pH 7.6); clear wavy boundary.

Cca 20 to 46 cm. (8 to 18 inches); Yellowish brown (10YR 5/4) light clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, firm, sticky, plastic; few coarse and few fine roots; few fine threads of calcium carbonate; moderate effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

R 46 cm. (18 inches); Very hard, calcareous, slabby sandstone.

EFFINGTON loam variant (East Ridge exclosure, Salt Bush site)
Soil Family: Typic Natrargids, fine, montmorillonitic, mesic.
Location: East Ridge exclosure, Washakie County; SE¼, NW¼, Sec. 33, T.48N., R.97W.
Climate: Annual precipitation is 5 to 7 inches. Mean annual soil temperature is about 51°F. Frost-free season is over 120 days. Elevation is 5,550 feet.
Vegetation and Land Use: Gardner saltbush, Sandberg bluegrass; used for grazing.
Parent Material: Residuum from gypsiferous shale.
Physiography: Upland hillsides.
Drainage: Well drained.
Moisture: Profile was moist to 20 inches when described.
Groundwater: None.
Erosion: Slight to moderate.
Permeability: Slow.
Sampled by: H. Fisser, L. Young, K. Spaeth, J. Orpet, J. Stephens, and D. Viktorin.
Described by: J. R. Stephens; 6/1/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 5 cm. (0 to 2 inches); Pale brown (10YR 6/3) loam, dark yellowish brown (10YR 4/4) moist; porous crust parting to moderate fine and medium crumb structure; slightly hard, friable, slightly sticky, slightly plastic; few fine and medium roots; weak effervescence; moderately alkaline (pH 8.0); clear smooth boundary.

B1 5 to 17 cm. (2 to 7 inches); Brown (10YR 5/3) silty clay loam, olive brown (2.5Y 4/4) moist; weak medium angular blocky structure; hard, firm, sticky, plastic; few fine and medium roots; few thin clay films on faces of peds; moderate effervescence; moderately alkaline (pH 8.0); clear wavy boundary.

B21t 17 to 31 cm. (7 to 12 inches); Pale brown (10YR 6/3) silty clay, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to moderate medium angular blocky; hard, firm, sticky, plastic; few medium and common coarse roots; few thin clay films on faces of peds; moderate effervescence; strongly alkaline (pH 9.0); clear smooth boundary.

B22t 31 to 51 cm. (12 to 20 inches); Yellowish brown (10YR 5/4) silty clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; very hard, very firm, very sticky, very plastic; few coarse roots; common thin clay films on faces of peds; moderate effervescence; very strongly alkaline (pH 9.2); clear smooth boundary.

Ccacs 51 to 63 cm. (20 to 25 inches); Pale brown (10YR 6/3) loam with white (10YR 8/2) specks of calcium carbonate, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; many fine specks and threads of calcium carbonate and soft masses of calcium sulfate crystals; moderate effervescence; moderately alkaline (pH 8.4); clear wavy boundary.

Cr 63 cm. (25 inches); Soft, platy, gypsiferous shale.

Absarokee Variant loam (Grass Creek Divide Exclosure, Type A).
Taxonomic Class: Fine, montmorillonitic Typic Argiborolls.
Location: Grass Creek Divide exclosure; Hot Springs County, Wyoming; NE1/4, SW1/4, Sec. 3, T.45N., R.100W.
Climate: Annual precipitation is about 16 inches. Mean annual soil temperature is about 45°F. Frost-free season is about 90 days, and the elevation is 7,000 feet.
Vegetation and Land Use: Western wheatgrass, oatgrass, big sagebrush; used for grazing.
Parent Material: Residuum from lignitic shale.
Physiography: Rolling hillside.
Drainage: Well drained.
Moisture: Soil profile was dry when described.
Groundwater: None.
Erosion: Slight.
Permeability: Moderately slow to slow.
Sampled By: H. Fisser, D. Trueblood, D. Samuelson, J. Bell, R. Kail, J. Stephens.
Described By: J. Stephens, D. Trueblood; 8-8-78.
(Colors are for air-dry soil unless otherwise noted).

A11 0 to 5 cm. (0 to 2 inches) Dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine, fine, and medium roots; neutral (pH 6.6); clear smooth boundary.

A12 5 to 20 cm. (2 to 8 inches) Dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common fine and medium roots; neutral (pH 6.8); clear smooth boundary.

B21t 20 to 51 cm. (8 to 20 inches) Grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, firm, sticky, plastic; very few medium roots; common thin patchy clay films on faces of peds; neutral (pH 7.2); gradual wavy boundary.

B22t 51 to 74 cm. (20 to 29 inches) Grayish brown (10YR 5/2) with patches of very dark grayish brown shale material, clay, dark grayish brown (10YR 4/2) mixed moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, very firm, very sticky, very plastic; very few medium roots; common thin clay films and a few thick patchy clay films on faces of peds; 15 percent very dark grayish brown soft shale chips; neutral (pH 7.0); gradual wavy boundary.

Ccr 74 cm. (29 inches) Soft, platy, lignitic shale.

Louviers Variant clay loam (Grass Creek Divide, Type B).
Taxonomic Class: Clayey, montmorillonitic (nonacid) frigid, shallow Ustic Torriorthents.
Location: Grass Creek Divide exclosure; Hot Springs County, Wyoming; NE1/4, SW1/4, Sec. 3, T.45N., R.100W.
Climate: Annual precipitation is about 16 inches. Mean annual soil temperature is about 45°F. The frost-free season is about 90 days, and the elevation is 7,000 feet.
Vegetation and Land Use: Oatgrass, sandwort; used for grazing.
Parent Material: Residuum from lignitic shale.
Physiography: Circular washout area.
Drainage: Excessive.
Moisture: Profile was dry when described.
Groundwater: None.
Erosion: Severely eroded.
Permeability: Very slow.
Sampled By: H. Fisser, D. Trueblood, D. Samuelson, J. Bell, R. Kail, J. Stephens.
Described By: J. Stephens, D. Trueblood; 8-8-78.
(Colors are for air-dry soil unless otherwise noted).

A1 0 to 5 cm. (0 to 2 inches) Light brownish gray (10YR 6/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; slightly hard, firm, sticky, plastic; very few medium roots; slightly acid (pH 6.4); abrupt smooth boundary.

B2 5 to 18 cm. (2 to 7 inches) Grayish brown (10YR 5/2) clay; dark grayish brown (10YR 4/2) moist; weak medium angular blocky structure; occasional medium roots; few coarse seams of salt crystals; 15 percent 1- to 2-inch flat sandstone fragments; slightly acid (pH 6.4); clear smooth boundary.

Cr 18 cm. (7 inches) Soft, noncalcareous lignitic shale.

Gateson Variant loam (Grass Creek Divide, Type C).
Taxonomic Classification: Fine, montmorillonitic Typic Eutroboralfs.
Location: Grass Creek Divide exclosure; Hot Springs County, Wyoming; NE1/4, SW1/4, Sec. 3, T.45N., R.100W.
Climate: Mean annual precipitation is about 16 inches. Mean annual soil temperature is about 45°F. Frost-free season is about 90 days, and elevation is 7,000 feet.
Vegetation and Land Use: Big sagebrush, Idaho fescue, bluegrass species; used for grazing.
Parent Material: Residuum from lignitic shale.
Physiography: Rolling upland hillside of about 6 percent slope, north-facing.
Drainage: Well drained.
Moisture: Soil profile was dry when described.
Groundwater: None within 5 feet.
Erosion: Slight.
Permeability: Slow.
Sampled By: H. Fisser, D. Trueblood, D. Samuelson, J. Bell, R. Kail, J. Stephens.
Described By: J. Stephens, D. Trueblood; 8-8-78.
(Colors are for air-dry soil unless otherwise noted).

A2 0 to 7 cm. (0 to 3 inches) Light brownish gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, friable, slightly sticky, slightly plastic; many fine and medium roots; 10 percent hard shale fragments 1/4 to 3/4 inch in size; neutral (pH 6.8); clear smooth boundary.

A&B 7 to 17 cm. (3 to 7 inches) Grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist with pockets of light brownish gray (10YR 6/2) materials; weak medium angular blocky structure; slightly hard, firm, sticky, plastic; common fine and medium roots; few thin clay films on faces of peds interspersed with patches of clean sand grains; neutral (pH 6.8); abrupt smooth boundary.

B1t 17 to 23 cm. (7 to 9 inches) Brown (10YR 5/3) heavy clay loam, dark brown (10YR 4/3) moist; moderate fine and medium angular blocky structure; hard, firm, sticky, plastic, common fine and medium roots; few thin patchy clay films on faces of peds; neutral (pH 6.8); clear smooth boundary.

B21t 23 to 48 cm. (9 to 19 inches) Grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium angular blocky; extremely hard, very firm, very sticky, very plastic; very few medium roots; thin nearly continuous clay films on faces of peds, and few thick clay films in old root channels; neutral (pH 6.6); gradual wavy boundary.

B22t 48 to 61 cm. (19 to 24 inches) Pale brown (10YR 6/3) clay, brown (10YR 4/3) moist; few very dark grayish brown (10YR 3/2) stains, and common medium yellowish brown (10YR 5/6) mottles; weak medium and coarse angular blocky structure; extremely hard, very firm, very sticky, very plastic; common moderately thick clay films on faces of peds; neutral (pH 7.2); gradual wavy boundary.

Ccr 61 cm. (24 inches) Soft lignitic shale.

Garo Variant silty clay (Grass Creek Divide, Type D).
Taxonomic Class: Clayey, montmorillonitic, shallow Borollic Haplargids.
Location: Grass Creek Divide exclosure; Hot Springs County, Wyoming; NE1/4, SW1/4, Sec. 3. T.45N., R.100W.
Climate: Annual precipitation is about 16 inches. Mean annual soil temperature is about 45°F. Frost-free season is about 90 days. Elevation is 7,000 feet.
Vegetation and Land Use: Big sagebrush, Hood phlox, mutton grass, Idaho fescue; used for grazing.
Parent Material: Residuum from weakly calcareous lignitic shale.
Physiography: Moderately sloping hillside.
Drainage: Somewhat excessively drained.
Moisture: Soil was dry throughout when described.
Groundwater: None within 5 feet.
Erosion: Slight to moderate.
Permeability: Slowly permeable.
Sampled By: H. Fisser, D. Trueblood, D. Samuelson, J. Bell, R. Kail, J. Stephens.
Described By: J. Stephens, D. Trueblood; 8-8-78.
(Colors are for air-dry soil unless otherwise noted).

A1 0 to 7 cm. (0 to 3 inches) Light brownish gray (10YR 6/2) silty clay, dark brown (10YR 4/3) moist; weak medium and coarse granular structure; hard, very firm, very sticky, very plastic; common fine and medium roots; neutral (pH 7.2); abrupt smooth boundary.

B2t 7 to 23 cm. (3 to 9 inches) Grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium and coarse angular blocky; extremely hard, very firm, very sticky, very plastic; few medium roots; common thin patchy clay films on faces of peds; 10 percent very dark grayish brown (10Y 3/2) 1/4 to 1/2 inch flat shale fragments; mildly alkaline (pH 7.6); clear smooth boundary.

B3tca 23 to 38 cm. (9 to 15 inches) Brown (10YR 5/3) silty clay, dark grayish brown (10YR 4/2) moist; weak medium angular blocky structure; hard, very firm, very sticky, very plastic; very few medium roots; few thin patchy clay films; few fine seams of calcium carbonate; 15 percent soft 1/4-inch to 1/2-inch flat shale fragments; violent effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

Ccr 38 cm. (15 inches) Soft lignitic shale that is weakly effervescent in spots.

Muff sandy clay loam 1/ (Halogeton Exclosure No.1 , East Site).
Taxonomic Class: Fine-loamy, mixed, mesic Typic Natrargids.
Location: Halogeton Pasture No. 1 exclosure; Big Horn County, Wyoming; NW¼, NE¼, Sec. 3, T.53N., R.95W.
Climate: Annual precipitation is 5.34 inches, based on 18 years' data. Mean annual soil temperature is about 50°F., frost-free season is more than 120 days, and the elevation is 4,200 feet.
Vegetation and Land Use: Gardner saltbush, bottlerush squirreltail, cactus; used for grazing.
Parent Material: Residuum from sandstone and local slopewash alluvium.
Physiography: Gently sloping footslope.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None.
Erosion: Moderate.
Permeability: Moderately permeable.
Sampled By: D. Trueblood, D. Samuelson, R. Kail, J. Stephens, M. Smith, C. Hansen.
Described By: J. Stephens, D. Samuelson; 8-10-78.
(Colors are for air-dry soils unless otherwise noted).

A2 0 to 5 cm. (0 to 2 inches) Very pale brown (10YR 7/3) sandy clay loam, dark brown (10YR 4/3) moist; weak thick platy structure; extremely hard, firm, sticky, plastic; very few coarse roots; strong effervescence; strongly alkaline (pH 8.8); abrupt smooth boundary.

B21t 5 to 25 cm. (2 to 10 inches) Light olive brown (2.5Y 5/4) heavy sandy clay loam, olive brown (2.5Y 4/4) moist; moderate medium columnar structure parting to moderate fine and medium angular blocky; extremely hard, firm, sticky, plastic; few fine, medium, and coarse roots; few thin patchy clay films on faces of peds; strong effervescence, very strongly alkaline (pH 9.2); clear smooth boundary.

B22t 25 to 46 cm. (10 to 18 inches) Pale brown (10YR 6/3) sandy clay loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to weak medium and coarse angular blocky; extremely hard, friable, slightly sticky, slightly plastic; few fine, medium, and coarse roots; common thin patchy clay films, and considerable clay bridging between sand grains; strong effervescence; very strongly alkaline (pH 9.2); gradual wavy boundary.

1/ Considered as taxadjunct to the Muff series. Depth to bedrock exceeds the range by 2 inches.

B23tca 46 to 73 cm. (18 to 29 inches) Light yellowish brown (25Y 6/4) heavy sandy loam, light olive brown (2.5Y 4/4) moist; weak medium angular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; very few medium and coarse roots; few thin patchy clay films; few coarse seams of calcium carbonate; violent effervescence; strongly alkaline (pH 9.0); gradual wavy boundary.

C1ca 73 to 107 cm. (29 to 42 inches) Light yellowish brown (2.5Y 6/4) sandy loam, light olive brown (2.5Y 5/4) moist; massive; hard, very friable, slightly sticky, slightly plastic; common fine and medium soft masses and seams of calcium carbonate; violent effervescence; strongly alkaline (pH 9.0); gradual wavy boundary.

C2cr 107 cm. (42 inches) Soft, calcareous sandstone.

MUDRAY VARIANT clay loam (Halogeton Exclosure No. 1, West Site)
Taxonomic Class: Loamy, mixed, mesic, shallow Typic Natrargids.
Location: Halogeton Pasture No. 1; Big Horn County, Wyoming; NW¼, NE¼, Sec. 3, T. 53N., R.95W.
Climate: Annual precipitation is 5.34 inches, based on 18 years' data. Mean annual soil temperature is about 50°F. The frost-free season is over 120 days, and the elevation is 4,200 feet.
Vegetation and Land Use: Gardner saltbush, bottlebrush squirreltail, cactus, bud sagewort. Used for grazing.
Parent Material: Residuum sandstone.
Physiography: Gently rolling ridgecrest.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None within 5 feet.
Erosion: Moderate.
Permeability: Moderate.
Sampled by: D. Trueblood, D. Samuelson, R. Kail, J. Stephens, M. Smith, and C. Hansen.
Described by: J. Stephens and D. Samuelson, 8/10/78.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 5 cm. (0 to 2 inches) Light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure with a vesicular crust on the surface, 1/4-inch thick; loose, firm, sticky, plastic; very few fine roots; strong effervescence; strongly alkaline (pH 8.8); clear smooth boundary.

B21t 5-12 cm. (2 to 5 inches) Pale brown (10YR 6/3) clay loam, yellowish brown (10YR 5/4) moist; weak medium angular blocky structure; slightly hard, firm, sticky, plastic; few fine and medium roots; few thin patchy clay films on vertical faces of peds; violent effervescence; very strongly alkaline (pH 9.2); clear smooth boundary.

B22t 12 to 25 cm. (5 to 10 inches) Pale brown (10YR 6/3) clay loam, yellowish brown (10YR 5/4) moist; weak medium angular blocky structure; hard, firm, sticky, plastic; few medium roots; few thin patchy clay films on vertical faces of peds; violent effervescence; very strongly alkaline (pH 9.4); gradual wavy boundary.

Ccr 25 cm. (10 inches) Soft, light gray, weakly calcareous sandstone.

UFFENS very fine sandy loam (Halogeton Exclosure No. 2)
Taxonomic Class: Fine-loamy, mixed, mesic Typic Natrargids.
Location: Halogeton Pasture No. 2; Big Horn County, Wyoming; NW¼, SW¼, Sec. 2, T.53N., R.95W.
Climate: Annual precipitation is 5.86 inches based on 6 years' data. Mean annual soil temperature is about 50°F. Frost-free season is more than 120 days. Elevation is 4,200 feet.
Vegetation and Land Use: Gardner saltbush, bottlebrush squirreltail, bud sagewort. Used for grazing.
Parent Material: Residuum from sandstone and slopewash alluvium.
Physiography: Nearly level footslope.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None within 5 feet.
Erosion: Moderate.
Permeability: Moderately slow.
Sampled by: D. Trueblood, D. Samuelson, R. Kail, J. Stephens, M. Smith, and C. Hansen.
Described by: J. Stephens and D. Samuelson, 8/10/78.
(Colors are for air-dry soil unless otherwise noted.)

A21 0-7 cm. (0 to 3 inches) Light gray (10YR 7/2) very fine sandy loam, dark brown (10YR 4/3) moist; weak thick platy structure; slightly hard, very friable, slightly sticky, slightly plastic; few fine and very few medium roots; strong effervescence; strongly alkaline (pH 8.6); clear smooth boundary.

A22 7-12 cm. (3 to 5 inches) Pale brown (10YR 6/3) light sandy clay loam, dark brown (10YR 4/3) moist; weak thin platy structure; slightly hard, friable, slightly sticky, slightly plastic; few fine and medium and very few coarse roots; strong effervescence; strongly alkaline (pH 8.8); abrupt smooth boundary.

B2t 12 to 40 cm. (5 to 16 inches) Pale brown (10YR 6/3) heavy sandy clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium angular blocky; extremely hard, firm, sticky, plastic; very few fine, medium and coarse roots; common thin patchy clay films on faces of peds and few moderately thin clay films in old root channels; violent effervescence; very strongly alkaline (pH 9.2); gradual wavy boundary.

B3tca 40 to 58 cm. (16 to 23 inches) Pale brown (10YR 6/3) heavy sandy clay loam, olive brown (2.5Y 4/4); moist; weak medium angular blocky structure; extremely hard, firm, sticky, plastic; very few fine, medium, and coarse roots; common thin patchy clay films on faces of peds; common fine and medium soft masses and seams of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.2); gradual smooth boundary.

C1ca 58 to 122 cm. (23 to 48 inches) Light brownish gray (2.5Y 6/2) sandy clay loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, firm, sticky, plastic; very few medium roots; common fine and medium soft masses and seams of calcium carbonate; many reddish yellow coarse sand grains; violent effervescence; strongly alkaline (pH 8.8); gradual wavy boundary.

C2cr 122 cm. (48 inches) Soft, calcareous sandstone.

PERSAYO sandy loam (Halogeton Exclosure No. 3, Ridgetop).
Taxonomic Class: Loamy, mixed (calcareous), mesic, shallow Typic Torriorthents.
Location: Halogeton Pasture No. 3; Big Horn County, Wyoming; SW¼, SE¼, Sec. 3, T.53N., R.95W.
Climate: Annual precipitation is 5.07 inches, based on 6 years' data at the site. Mean annual soil temperature is about 50°F. The frost-free season is more than 120 days, and the elevation is 4,200 feet.
Vegetation and Land Use: Gardner saltbush, bud sagewort, bottlebrush squirreltail. Used for grazing.
Parent Material: Residuum from interbedded sandstone and shale.
Physiography: Rolling ridge.
Drainage: Excessively drained.
Moisture: Profile was dry when described.
Groundwater: None within 5 feet.
Erosion: Moderate.
Permeability: Moderately rapid.
Sampled by: D. Trueblood, D. Samuelson, R. Kail, J. Stephens, M. Smith, and C. Hansen.
Described by: J. Stephens and D. Samuelson, 8/10/78.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 7 cm. (0 to 3 inches) Light brownish gray (10YR 6/2) sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure with 1/4- to 1/2-inch vesicular crust on the surface; slightly hard, very friable, slightly sticky, slightly plastic; very few fine roots; strong effervescence; moderately alkaline (pH 8.2); clear smooth boundary.

C1ca 7 to 28 cm. (3 to 11 inches) Brown (10YR 5/3) light sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few fine and medium roots; very few fine specks of calcium carbonate; violent effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

C2ca 28 to 46 cm. (11 to 18 inches) Light yellowish brown (10YR 6/4) light sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few medium roots; many fine specks of calcium carbonate; violent effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

C3cr 46 cm. (18 inches) Interbedded soft, calcareous sandstone and shale.

EFFINGTON clay loam (Halogeton Exclosure No. 3, Swale).
Taxonomic Class: Fine, montmorillonitic, mesic Typic Natrargids.
Location: Halogeton Pasture No. 3; Big Horn County, Wyoming; SW¼, SE¼, Sec. 3, T.53N., R.95W.
Climate: Annual precipitation is 5.07 inches, based on 6 years' data at the site. Mean annual soil temperature is about 50°F. The frost-free season is over 120 days, and the elevation is 4,200 feet.
Vegetation and Land Use: Gardner saltbush, bottlebrush squirreltail. Used for grazing.
Parent Material: Slopewash alluvium.
Physiography: Nearly level alluvial fan.
Drainage: Well drained.
Moisture: Profile was dry to 60 inches when described.
Groundwater: None within 60 inches.
Erosion: Moderate.
Permeability: Slowly permeable.
Sampled by: D. Trueblood, D. Samuelson, R. Kail, J. Stephens, M. Smith, and C. Hansen.
Described by: J. Stephens and D. Samuelson, 8/10/78.
(Colors are for air-dry soil unless otherwise noted.)

A2 0 to 7 cm. (0 to 3 inches) Pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak thick platy structure parting to weak fine angular blocky; hard, firm, sticky, plastic; very few fine and medium roots; strong effervescence; strongly alkaline (pH 8.8); abrupt smooth boundary.

B21t 7 to 30 cm. (3 to 12 inches) Pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium angular blocky; hard, firm, sticky, plastic; very few fine, medium, and coarse roots; common thin patchy clay films on vertical faces of peds; strong effervescence; very strongly alkaline (pH 9.6); clear smooth boundary.

B22tca 30 to 61 cm. (12 to 24 inches) Brown (10YR 5/3) heavy silty clay loam, olive brown (2.5Y 4/4) moist; weak coarse angular blocky structure; hard, firm, sticky, plastic; very few fine and medium roots; few thin patchy clay films on vertical faces of peds; common fine threads and soft masses of calcium carbonate; violent effervescence; strongly alkaline (pH 9.0); gradual wavy boundary.

C1ca 61 to 91 cm. (24 to 36 inches) Light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; hard, firm, sticky, plastic; very few medium roots; many fine and medium seams and soft masses of calcium carbonate; violent effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

C2ca 91 to 153 cm. (36 to 60 inches) Light yellowish brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; many fine specks and threads of calcium carbonate; many fine filaments of mycelial mold; violent effervescence; moderately alkaline (pH 8.2).

BRIBUTTE loam (Hawk exclosure, site 1, saltbush type)
Soil Family: Typic Torriorthents, clayey, montmorillonitic (calcareous), mesic, shallow.
Location: Hawk exclosure, Washakie County; NE¼, NE¼, Sec. 4, T.48N., R.95W.
Climate: Mean annual precipitation is 5.94 inches based on 13-years' data. Mean annual soil temperature is about 50° F. Frost-free season is 110 to 140 days. Elevation is 4,500 feet.
Vegetation and Land Use: Gardner saltbush, birdfoot sagebrush; used for grazing.
Parent Material: Platy shale, Willwood formation.
Physiography: Rolling uplands.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None, more than 5 feet.
Erosion: Moderate.
Permeability: Slow.
Sampled by: H. Fisser, University of Wyoming crew, and J. Stephens; 6/1/77.
Described by: J. R. Stephens; 6/1/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 2.5 cm. (0 to 1 inch); Brown (10YR 5/3) heavy loam, dark brown (10YR 4/3) moist; vesicular crust that parts to weak fine granular structure; soft, friable, slightly sticky, slightly plastic; very few fine roots; moderate effervescence; strongly alkaline (pH 8.8); clear smooth boundary.

C1 2.5 to 7.5 (1 to 3 inches); Brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium and coarse angular blocky structure; very hard, firm, sticky, plastic; very few fine roots; moderate effervescence; very strongly alkaline (pH 9.4); clear smooth boundary.

C2 7.5 to 18 cm. (3 to 7 inches); Yellowish brown (10YR 5/4) shaly silty clay loam, dark brown (10YR 4/3) moist; massive; hard, firm, sticky, plastic; very few fine roots; 25 percent 1/4- to 1/2-inch gray shale platelets; moderate effervescence; very strongly alkaline (pH 9.4); gradual wavy boundary.

Cr1 18 to 28 cm. (7 to 11 inches); Soft, calcareous, platy shale; very strongly alkaline (pH 9.0).

Cr2 28 cm. (11 inches); Hard, dark gray, calcareous shale; hardness estimated as 2.5 on Mohs scale.

TIPPER loamy sand, sandstone bedrock variant (Hawk exclosure, site 2, spiny hopsage type)
Soil Family: Typic Torripsamments, mixed, mesic, shallow.
Location: Hawk exclosure, Washakie County; NE¼, NE¼, Sec. 4, T.48N., R.95W.
Climate: Mean annual precipitation is 5.94 inches based on 13-years' data. Mean annual soil temperature is about 50°F. Frost-free season is 110 to 140 days. Elevation is 4,500 feet.
Vegetation and Land Use: Spiny hopsage, big sagebrush, cactus, blue grama; used for grazing.
Parent Material: Wind-blown deposits that mantle underlying soils.
Physiography: Upland ridges with thin dunes.
Drainage: Somewhat excessively drained.
Moisture: Profile was dry when described.
Groundwater: None or more than 5 feet.
Erosion: Slight to moderate.
Permeability: Rapid.
Sampled by: H. Fisser, J. Stephens, J. Orpet, L. Young, K. Spaeth, D. Viktorin.
Described by: J. R. Stephens; 6/1/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 12.5 cm. (0 to 5 inches); Light brownish gray (2.5Y 6/2) loamy sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, very friable, nonsticky, nonplastic; few coarse and fine roots; weak effervescence; moderately alkaline (pH 8.2); clear smooth boundary.

C1 12.5 to 33 cm. (5 to 13 inches); Pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; massive; slightly hard, loose, nonsticky, nonplastic; few fine and coarse roots; moderate effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

IICca 33 to 46 cm. (13 to 18 inches); Pale brown (10YR 6/3) sandy clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; very few coarse roots; many fine threads of calcium carbonate; violent effervescence; strongly alkaline (pH 8.8); gradual wavy boundary.

IICr 46 cm. (18 inches); Soft, pale brown, calcareous sandstone.

THEDALUND very fine sandy loam, dry variant (Horse Creek exclosure--AGSM type)
Soil Family: Ustic Torriorthents, fine-loamy, mixed, mesic
Location: Horse Creek exclosure, Big Horn county, SW¼, SW¼, Sec. 1, T 53N, R 91W
Climate: Annual precipitation is 8 to 13 inches. Mean annual soil temperature is 47 to 50°F. Frost-free season is 110 to 120 days.
Vegetation and Land Use: big sagebrush, western wheatgrass; grazing
Parent Material: moderately fine textured calcareous local alluvium
Physiography: alluvial fans and drainageways, slopes 0 to 5 percent
Drainage: well drained
Permeability: moderate
Described by: C. Fowkes, 1971

A1 0-3" Grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse platy parting to strong fine granular structure; soft, very friable, slightly sticky, slightly plastic, common micro, very fine, and fine, very few medium and coarse roots; common fine and medium pores; noncalcareous; moderately alkaline, pH 8.0 (T.B.); abrupt smooth boundary.

B2 3-8" Brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate fine prismatic parting to moderate coarse and medium subangular blocky structure; hard, friable, sticky, plastic; many micro, very fine, and fine, few medium and coarse roots; common fine pores; noncalcareous; moderately alkaline, pH 8.2 (T.B.); clear wavy boundary.

B3ca 8-17" Pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak, medium prismatic parting to moderate medium and fine subangular blocky structure; hard, friable, sticky, plastic; common fine and medium, few coarse roots; common fine pores; calcareous; common medium and fine soft concretions, streaks, and seams of calcium carbonate; strongly alkaline, pH 8.7 (T.B.); gradual wavy boundary.

Cca 17-23" Light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky, plastic; few fine roots; few fine pores; calcareous; common coarse and medium soft concretions, streaks, and seams of calcium carbonate; strongly alkaline, pH 9.0 (T.B.); gradual wavy boundary.

R 23+ Hard interbedded silty sandstone and claystone. Several inches of the upper part is partially weathered, and seams of calcium carbonate occur on the surfaces of the fractures.

Remarks: Cooperative range-soil study with Range Department of University of Wyoming. This pedon was described at the Horse Creek exclosure.

THEDALUND loam, dry variant (Horse Creek exclosure--AGSP type)
Soil Family: Ustic Torriorthents, fine-loamy, mixed (calcareous), mesic
Location: Horse Creek exclosure, Big Horn county, SW¼, SW¼, Sec. 1, T 53N, R91W
Climate: Annual precipitation is 8 to 13 inches. Mean annual soil temperature is 47 to 50°F. Frost free season is 110 to 120 days.
Vegetation and Land Use: big sagebrush, bluebunch wheatgrass; grazing
Parent Material: moderately fine textured calcareous sediments from silty sandstone and claystone.
Physiography: upland slopes, 3 to 10 percent
Drainage: well drained
Permeability: moderately slow
Described by: C. Fowkes, 1971

A1 0-3" Brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; common micro, very fine, and fine roots; calcareous; moderately alkaline, pH 8.2 (T.B.); abrupt smooth boundary.

AC 3-9" Pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate fine and very fine subangular blocky structure; slightly hard, friable, sticky, plastic; common micro, very fine, and fine, few medium and coarse roots; common fine, few medium pores; calcareous; strongly alkaline, pH 8.6 (T.B.); clear wavy boundary.

Cca 9-18" Light gray (2.5Y 7/2) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure; hard, firm, sticky, plastic; common micro, very fine, and fine, few medium and coarse roots; few fine and medium pores; calcareous; common medium and fine soft concretions and seams of calcium carbonate; strongly alkaline, pH 9.0 (T.B.); gradual wavy boundary.

CR 18-24" Light brownish gray (2.5Y 6/2) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate coarse and medium subangular blocky structure; very hard, firm, sticky, plastic; few fine roots; few fine pores; contains much weathered bedrock material; calcareous; strongly alkaline, pH 9.0 (T.B.); gradual wavy boundary.

R 24"+ Hard interbedded silty sandstone and claystone.

Remarks: Cooperative range-soil study with Range Department of University of Wyoming. This profile was described at the Horse Creek A.G.S.P. Exclosure.

RENTSAC gravelly sandy loam, warm variant (Horse Creek exclosure--ARNO type)
Soil Family: Lithic Ustic Torriorthents, loamy--skeletal, mixed (calcareous), mesic
Location: Horse Creek exclosure, Big Horn county, SW¼, SW¼, Sec. 1, T 53N, R 91W
Climate: Annual precipitation is 8 to 13 inches. Mean annual soil temperature is 47 to 50°F. Frost-free season is 110 to 120 days.
Vegetation and Land Use: black sagebrush, bluebunch wheatgrass; grazing
Parent Material: moderately sandy materials from sandstone
Physiography: steep sloping crests and ledges, slopes 10 to 20 percent
Drainage: well drained
Permeability: rapid
Described by: C. Fowkes, 1971

A1 0-4" Reddish brown (10YR 5/2) gravelly sandy loam, drak grayish brown (10YR 4/2) moist; weak very fine granular structure; soft, very friable, nonsticky, nonplastic; common micro, very fine, and fine, few medium and coarse roots; 15 percent coarse sandstone fragments; calcareous; strongly alkaline, pH 8.4 (T.B.); clear wavy boundary.

AC 4-9" Light brownish gray (10YR 6/2) gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky, nonplastic; many fine, medium, and coarse roots; 30 percent coarse sandstone fragments; calcareous; calcium carbonate disseminated and as coating on the coarse fragments; strongly alkaline, pH 8.5 (T.B.); diffuse irregular boundary.

CR 9-19" Light gray (10YR 7/2) stony sandy loam; single grained; loose, very friable, nonsticky, nonplastic; few fine roots to 16 inches; 80 percent coarse fragments gravel to boulder size; calcareous; calcium carbonate disseminated and as coatings on coarse fragments; strongly alkaline, pH 8.6 (T.B.); diffuse irregular boundary.

R 19"+ Hard fractured sandstone.

Remarks: Cooperative range-soil study with the Range Department of University of Wyoming. This profile was described at the Horse Creek exclosure having black sage cover.

FIVEMILE loam variant (Kirby Creek exclosure)
Soil Family: Typic Torrifluvents, fine-silty, mixed (calcareous), mesic.
Location: Kirby Creek exclosure, Hot Springs County; SW¼, NW¼, Sec. 36, T.44N., R.94W.
Climate: Mean annual precipitation is 8.94 inches based on 12-years' data. Mean annual soil temperature is about 51°F. Frost-free season is more than 120 days. Elevation is 4,400 feet.
Vegetation and Land Use: Vegetation is dominantly greasewood; use is for grazing.
Parent Material: Alluvium and slopewash.
Physiography: Nearly level alluvial fan.
Drainage: Well drained.
Moisture: Dry to 60 inches when described.
Groundwater: More than 5 feet.
Erosion: Slight.
Permeability: Moderately slow.
Sampled by: H. Fisser, J. Stephens, J. Orpet, K. Spaeth, and L. Young.
Described by: J. R. Stephens
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 5 cm. (0 to 2 inches); Light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; vesicular crust parting to weak fine granular structure; soft, friable, slightly sticky, slightly plastic; many fine and medium roots; weak effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

C1 5 to 33 cm. (2 to 13 inches); Olive (5Y 5/4) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, firm, sticky, plastic; few medium and coarse roots; moderate effervescence; strongly alkaline (pH 8.6); clear wavy boundary.

C2 33 to 64 cm. (13 to 25 inches); Light brownish gray (2.5Y 6/2) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, firm, sticky, plastic; very few coarse roots; violent effervescence; very strongly alkaline (pH 9.4); clear wavy boundary.

C1casa 64 to 122 cm. (25 to 48 inches); Pale olive (5Y 6/3) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, sticky, plastic; many fine specks of calcium carbonate and salts; violent effervescence; very strongly alkaline (pH 9.2); clear wavy boundary.

C2cacs 122 to 152 cm. (48 to 60 inches); Grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky, plastic; many fine specks of calcium carbonate and salts; violent effervescence; strongly alkaline (pH 8.8).

FORELLE loam (Lower Enos Creek exclosure)
Soil Family: Borollic Haplargids, fine-loamy, mixed.
Location: Lower Enos Creek exclosure; Hot Springs County; SW¼, NE¼, Sec. 19, T.46N., R.99W.
Climate: Annual precipitation is about 10 inches (10.22 inches based on 7-years' data). Mean annual soil temperature is about 45°F. Frost-free season is 90 to 140 days. Elevation is 6,180 feet.
Vegetation and Land Use: Western wheatgrass, Idaho fescue, silver sagebrush, prairie junegrass; the area outside the exclosure is used for grazing.
Parent Material: Alluvium derived from slopewash.
Physiography: Gently sloping alluvial fan.
Drainage: Well drained.
Moisture: Profile was moist to 60 inches.
Groundwater: More than 5 feet.
Erosion: Slight.
Permeability: Moderate.
Sampled by: L. Young, K. Spaeth, J. Stephens.
Described by: J. R. Stephens; 6/3/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 7.5 cm. (0 to 3 inches); Light brownish gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; many fine medium and coarse roots; neutral (pH 6.8); clear smooth boundary.

B21t 7.5 to 25 cm. (3 to 10 inches); Grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium prismatic parting to moderate fine and medium angular blocky structure; hard, firm, sticky plastic; few fine medium and coarse roots; common thin clay films on faces of peds; neutral (pH 7.0); clear smooth boundary.

B22t 25 to 61 cm. (10 to 24 inches); Light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic parting to moderate medium angular blocky structure; hard, firm, sticky, plastic; few medium and coarse roots; common thin clay films on faces of peds; mildly alkaline (pH 7.4); clear wavy boundary.

B3tca 61 to 81 cm. (24 to 32 inches); Light brownish gray (10YR 6/2) heavy sandy loam, dark grayish brown (10YR 4/2) moist; weak medium angular blocky structure; slightly hard, firm, slightly sticky, slightly plastic; few coarse roots; few thin patchy clay films on faces of peds; common medium threads of calcium carbonate; moderate effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

Cca 81 to 152 cm. (32 to 60 inches); Pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; many fine specks and threads of calcium carbonate; violent effervescence; strongly alkaline (pH 8.6).

POTTS very fine sandy loam, thin solum variant (North Butte Relict Area)
Soil Family: Ustollic Haplargids, fine-loamy, mixed, mesic
Location: North Butte Relict Area, Hot Springs county, SW¼, SW¼, Sec. 25, T 43N, R 95W
Climate: Annual precipitation is 8 to 13 inches. Mean annual soil temperature is 47 to 50°F. Frost-free season is 110 to 120 days.
Vegetation and Land Use: big sagebrush, bluebunch wheatgrass
Parent Material: medium textured calcareous sediments from sandstone and shale.
Physiography: upland slopes, 6 to 10 percent
Drainage: well drained
Permeability: moderate
Described by: C. Fowkes, 1971

A11 0-2" Light brown (7.5 YR 6/3) very fine sandy loam, dark brown (7.5YR 4/2) moist; moderate fine granular structure; soft, very friable, nonsticky, nonplastic; noncalcareous; moderately alkaline, pH 8.0 (T.B.); abrupt smooth boundary.

A12 2-4" Brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 4/3) moist; weak fine platy parting to moderate fine granular structure; soft, very friable, nonsticky, nonplastic; many micro, very fine, and fine, common medium and coarse roots; noncalcareous; moderately alkaline, pH 8.2 (T.B.); abrupt smooth boundary.

B2t 4-7" Reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak medium prismatic parting to moderate medium and fine subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many micro, very fine, and fine, common medium and coarse roots; many micro, very fine, and fine pores; thin patches of glossy coatings along root channels; noncalcareous; strongly alkaline, pH 8.4 (T.B.); clear wavy boundary.

B3ca 7-13" Light brown (7.5YR 6/3) loam, dark brown (7.5YR 4/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many micro, very fine, and fine, common medium and coarse roots; many micro, very fine, and fine, few common medium pores; few thin patches of glossy coatings along root channels; calcareous; calcium carbonate disseminated and in common fine soft concretions and seams; strongly alkaline, pH 8.8 (T.B.); gradual wavy boundary.

C1ca 13-29" Very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak coarse medium subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; few micro, very fine, and fine roots; many micro, very fine, and fine, few medium and coarse pores; calcareous; many medium to fine soft concretions, threads, and seams of calcium carbonate; strongly alkaline, pH 8.8 (T.B.); gradual wavy boundary.

C2 29-40" Pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; very few fine roots to 34 inches; common fine few medium pores; calcareous; few threads and seams of calcium carbonate; very strongly alkaline, pH 9.4 (T.B.).

Remarks: Cooperative range-soil study with the Range Department of University of Wyoming. The pedon was described at the North Butte exclosure.

LOSTWELLS very fine sandy loam[1/] (Potato Ridge Exclosure).
Taxonomic Class: Fine-loamy, mixed (calcareous), mesic Typic Torrifluvents.
Location: Potato Ridge Exclosure; Big Horn County, Wyoming; NW¼, NE¼, Sec. 33, T.52N., R.91W.
Climate: Annual precipitation is 7.07 inches, based on 10 years' data at the site. Mean annual soil temperature is about 50°F. The frost-free season is about 120 days, and the elevation is 4,585 feet.
Vegetation and Land Use: Gardner saltbush, big sagebrush, bluebunch wheatgrass, winterfat, and Indian ricegrass. Used for grazing.
Parent Material: Local slopewash alluvium.
Physiography: Narrow, gently sloping alluvial fan.
Drainage: Well drained.
Moisture: Profile was dry to 60 inches when described.
Groundwater: None within 60 inches.
Erosion: Moderate.
Permeability: Moderate.
Sampled by: D. Trueblood, D. Samuelson, J. Stephens.
Described by: J. Stephens, 8/11/78.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 5 cm. (0 to 2 inches) Light brown (10YR 6/4) very fine sandy loam, dark brown (7.5YR 4/4) moist; weak thick platy structure; soft, very friable, slightly sticky, slightly plastic; very few fine roots; violent effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

C1 5 to 17 cm. (2 to 7 inches) Light yellowish brown (10YR 6/4) sandy loam, dark brown (10YR 4/3) moist; massive; loose, friable, nonsticky, nonplastic; few fine and medium roots; 15 percent very fine gravel; violent effervescence; moderately alkaline (pH 8.2); clear smooth boundary.

C2 17 to 68 cm. (7 to 27 inches) Pale brown (10YR 6/3) very fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots, several filled rodent burrows; violent effervescence; moderately alkaline (pH 8.2); clear smooth boundary.

C3 68 to 84 cm. (27 to 33 inches) Light brown (7.5YR 6/4) gravelly loam, dark brown (7.5YR 4/4) moist; massive; soft, friable, slightly sticky, slightly plastic; few medium roots; 25 percent very fine and fine gravel; violent effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

C4ca 84 to 122 cm. (33 to 48 inches) Light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; very few medium roots; common fine and medium soft masses of calcium carbonate; violent effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

C5ca 122 to 153 cm. (48 to 60 inches) Pink (7.5YR 7/4) loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, sticky, plastic; common fine and medium soft masses of calcium carbonate; 10 percent very fine gravel; violent effervescence; moderately alkaline (pH 8.4).

1/This pedon is considered as taxadjunct to the series. Some horizons exceed the range of characteristics in color, coarse fragments, etc.

NEIBER very fine sandy loam variant (Rankin Basin exclosure)
Soil Family: Typic Haplargids, fine-loamy, mixed, mesic.
Location: Rankin Basin exclosure, Hot Springs County; NW¼, Sec. 7, T.46N., R.97W.
Climate: Annual precipitation ranges from 5 to 7 inches. Mean annual soil temperature is about 51°F. Frost-free season is over 120 days. Elevation is 5,200 feet.
Vegetation and Use: Big sagebrush, blue grama, needleandthread, cactus; use is for grazing.
Parent Material: Residuum from soft, interbedded sandstone and shale.
Physiography: Rolling uplands.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None.
Erosion: Slight.
Permeability: Moderate.
Sampled by: L. Young and J. Stephens.
Described by: J. R. Stephens; 7/11/77.
(Colors are for air-dry soil unless otherwise noted.)

A2 0 to 7.5 cm. (0 to 3 inches); Light gray (10YR 7/1) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to weak coarse granules; slightly hard, very friable, nonsticky, nonplastic; many fine and medium and few coarse roots; neutral (pH 7.2); clear smooth boundary.

B21t 7.5 to 23 cm. (3 to 9 inches); Grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse angular blocky; hard, firm, sticky, plastic; common fine and medium and few coarse roots; common thin clay films on faces of peds; mildly alkaline (pH 7.4); clear smooth boundary.

B22tca 23 to 38 cm. (9 to 15 inches); Light brownish gray (10YR 6/2) sandy clay loam with white (10YR 8/2) calcium carbonate seams, dark grayish brown (10YR 4/2) moist; weak medium and coarse prismatic structure parting to weak medium and coarse angular blocky; hard, firm, slightly sticky, slightly plastic; few medium and coarse roots; few thin clay films on faces of peds; common fine and medium distinct seams of calcium carbonate; moderate effervescence; strongly alkaline (pH 8.6); clear smooth boundary.

B3tca 38 to 74 cm. (15 to 29 inches); Pale brown (10YR 6/3) sandy clay loam with white (10YR 8/2) calcium carbonate seams, dark grayish brown (10YR 4/2) moist; weak coarse angular blocky structure; hard, firm, sticky, plastic; few thin clay films in root channels and coatings on sand grains; very few coarse roots to 23 inches; many fine and medium distinct seams of calcium carbonate; violent effervescence; strongly alkaline (pH 8.8); gradual wavy boundary.

Cca 74 to 107 cm. (29 to 42 inches); Pale brown (10YR 6/3) light sandy clay loam with very pale brown calcium carbonate seams, dark brown (10YR 4/3) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium seams of calcium carbonate; violent effervescence; strongly alkaline (pH 8.6); gradual wavy boundary.

Cr 107 cm. (42 inches); Soft, calcareous, interbedded sandstone and shale.

REKOP loam (Round Top Mountain Relict Area)
Soil Family: Ustic Torriorthents, loamy, gypsic, mesic, shallow
Location: Round Top Mountain Relict Area, Hot Springs county, SE¼, SE¼, Sec. 26, T 43N, R 95W
Climate: Annual precipitation is 8 to 13 inches. Mean annual soil temperature is 47 to 50°F. Frost-free season is 110 to 120 days.
Vegetation and Land Use: big sagebrush, bluebunch wheatgrass
Parent Material: thin highly calcareous and gypsiferous materials from gyp rock.
Physiography: uplands, slopes 5 to 20 percent
Drainage: well drained
Permeability: moderate
Described by: C. Fowkes, 1971

A11 0-1" Light brown (7.5YR 6/2) loam, dark brown (7.5YR 4/2) moist; weak fine crumb structure; soft, very friable, nonsticky, nonplastic; calcareous; moderately alkaline, pH 8.0 (T.B.); abrupt smooth boundary.

A12 1-3" Reddish gray (5YR 5/2) loam, dark reddish gray (5YR 4.2) moist; moderate fine granular structure; soft, very friable, nonsticky, slightly plastic; many micro, very fine, and fine, common medium and coarse roots; many micro, very fine, and fine, few medium and coarse pores; calcareous; moderately alkaline, pH 8.2 (T.B.); abrupt smooth boundary.

AC 3-8" Reddish brown (7.5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky, plastic; many micro, very fine, and fine, common medium and coarse roots; many micro, very fine, and fine, few medium and coarse pores; calcareous strongly alkaline, pH 8.4 (T.B.); clear wavy boundary.

C2cs 8-13" Light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; weak medium and fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; many micro, very fine, and fine, common medium and coarse roots; many micro, very fine, and fine, few medium and coarse pores; calcareous; common medium and fine soft concretions and seams of calcium carbonate; common fine nests of gypsum; strongly alkaline, pH 8.5 (T.B.); clear wavy boundary.

C3cs 13-20" Pink (7.5YR 7/2) loam, light brown (7.5YR 6/4) moist; weak medium and fine subangular blocky structure; soft, very friable sticky, plastic; many micro, very fine, and fine, common medium and coarse roots; many micro, very fine, and fine, few medium and coarse pores; calcareous; many fine soft concretions and seams of calcium carbonate; many fine nests of gypsum; strongly alkaline, pH 8.5 (T.B.); gradual wavy boundary.

C3 20"+ Soft weathered gyp rock.

Remarks: Cooperative range-soil study with the Range Department of University of Wyoming. This pedon was described at the Roundtop exclosure.

EFFINGTON loamy sand variant (Sand Creek exclosure, Bud Sagebrush site)
Soil Family: Typic Natrargids, fine, montmorillonitic, mesic.
Location: Sand Creek exclosure, Washakie County; SE¼, NE¼, Sec. 18, T.48N., R. 91W.
Climate: Nine-year average annual precipitation is 6.54 inches. Mean annual soil temperature is about 51°F. Frost-free season is over 120 days. Elevation is 4,290 feet.
Vegetation and Use: Bud sagebrush, big sagebrush, Gardner saltbush, cactus, Sandberg bluegrass; used for grazing.
Parent Material: Residuum from sandy shale and shale.
Physiography: Rolling uplands.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None within 5 feet.
Erosion: Moderate wind erosion.
Permeability: Moderately slow to slow.
Sampled by: H. Fisser, L. Young, C. McAfee, and J. Stephens.
Described by: J. R. Stephens; 7/13/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 7.5 cm. (0 to 3 inches); Pale brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) moist; single grained; soft, loose, nonsticky, nonplastic; many fine and medium roots; mildly alkaline (pH 7.6); clear smooth boundary.

A2 7.5 to 17.5 cm. (3 to 7 inches); Light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2); moderate medium platy parting to weak fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; few fine medium and coarse roots; mildly alkaline (pH 7.4); abrupt smooth boundary.

B21tca 17.5 to 33 cm. (7 to 13 inches); Yellowish brown (10YR 5/4) with very pale brown calcium carbonate masses, heavy clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium prismatic structure parting to moderate fine and medium angular blocky; hard, firm, sticky, plastic; few medium and coarse roots; common thin waxy coatings on faces of peds; many coarse soft masses of calcium carbonate; moderate effervescence; very strongly alkaline (pH 9.0); clear smooth boundary.

B22tca 33 to 50 cm. (13 to 20 inches); Pale brown (10YR 6/3) with very pale brown (10YR 8/3) calcium carbonate masses, heavy clay loam, dark brown (10YR 4/3) moist; moderate fine and medium prismatic structure parting to moderate fine and medium angular blocky; hard, firm, sticky, plastic; few coarse roots; common thin waxy coatings on faces of peds; many coarse soft masses of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.2); clear smooth boundary.

B3tca 50 to 66 cm. (20 to 26 inches); Light brownish gray (2.5Y 6/2) with white (2.5Y 8/2) calcium carbonate mottles, heavy clay loam, dark grayish brown (2.5Y 4/3) moist; weak coarse angular blocky structure; hard, firm, sticky, plastic; few thin waxy coatings on faces of peds and in old root channels, many coarse soft masses of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.0); gradual wavy boundary.

Cca 66 to 86 cm. (26 to 34 inches); Light brownish gray (2.5Y 6/2) with white (2.5Y 8/2) calcium carbonate masses, sandy clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky, plastic; many coarse soft masses of calcium carbonate; violent effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

Cr 86 cm. (34 inches); Soft, olive, calcareous sandy shale.

GRIFFY fine sandy loam variant (Sand Creek exclosure, Big Sagebrush site)
Soil Family: Typic Haplargids, fine-loamy over sandy or sandy-skeletal, mixed, mesic.
Location: Sand Creek exclosure, Washakie County; SE¼, NE¼, Sec. 18, T.48N., R.91W.
Climate: Nine-year average annual precipitation is 6.54 inches. Mean annual soil temperature is about 51°F. Frost-free season is over 120 days. Elevation is 4,290 feet.
Vegetation and Use: Big sagebrush, western wheatgrass, needleandthread, cactus; used for grazing.
Parent Material: Terrace outwash material.
Physiography: Terrace remnant.
Drainage: Well drained.
Moisture: Profile was dry to 60 inches when described.
Groundwater: None within 5 feet.
Erosion: Slight to moderate.
Permeability: Moderate.
Sampled by: H. Fisser, L. Young, C. McAfee, and J. Stephens.
Described by: J. R. Stephens; 7/13/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 7.5 cm. (0 to 3 inches); Light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium and few coarse roots; mildly alkaline (pH 7.4); clear smooth boundary.

B2t 7.5 to 33 cm. (3 to 13 inches); Brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium and coarse angular blocky structure; hard, friable, slightly sticky, slightly plastic; few fine medium and coarse roots; few thin waxy coatings on ped surfaces; moderate effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

B3tca 33 to 51 cm. (13 to 20 inches); Pale brown (10YR 6/3) heavy loam with white (10YR 8/2) calcium carbonate masses, grayish brown (2.5Y 5/2) moist; weak coarse angular blocky structure; hard, firm, sticky, plastic; few coarse roots; few thin waxy coatings on faces of peds; many medium and coarse seams and soft masses of calcium carbonate; violent effervescence; strongly alkaline (pH 8.8); gradual wavy boundary.

C1ca 51 to 76 cm. (20 to 30 inches); Light brownish gray (2.5Y 6/2) loam with white (2.5Y 8/2) calcium carbonate masses, grayish brown (10YR 5/2) moist; massive; hard, firm, sticky, plastic; many coarse soft masses of calcium carbonate; violent effervescence; strongly alkaline (pH 9.0); clear smooth boundary.

IIC2ca 76 to 127 cm. (30 to 50 inches); Brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; massive; loose, friable, nonsticky, nonplastic; fine disseminated calcium carbonate; 20 to 30 percent 1/2- to 1-inch gravel; violent effervescence; strongly alkaline (pH 8.6); gradual wavy boundary.

IIC3ca 127 to 152 cm. (50 to 60 inches); Pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; massive; loose, friable, slightly sticky, slightly plastic; fine disseminated calcium carbonate; 15 to 20 percent 1/2- to 1-inch gravel; violent effervescence; strongly alkaline (pH 8.6).

MUFF very fine sandy loam (Sand Gulch exclosure)
Soil Family: Typic Natrargids, fine-loamy, mixed, mesic.
Location: Sand Gulch exclosure, Hot Springs County; NW¼, SE¼, Sec. 29, T44N., R.93W.
Climate: Mean annual precipitation is 8.74 inches based on 13-years' data. Mean annual soil temperature is 47° to 53°F. Frost-free season is over 120 days. Elevation is 4,450 feet.
Vegetation and Land Use: Gardner saltbush, western wheatgrass; used for grazing outside of exclosure.
Parent Material: Residuum from gypsiferous sandy shales.
Physiography: Rolling uplands.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None.
Erosion: Slight.
Permeability: Moderately slow.
Sampled by: H. Fisser, J. Stephens, J. Orpet, K. Spaeth, and L. Young.
Described by: J. R. Stephens; 6/2/77.
(Colors are for air-dry soil unless otherwise noted.)

A21 0 to 2.5 cm. (0 to 1 inch); Light gray (10YR 7/2) very fine sandy loam, brown (10YR 5/3) moist; vesicular crust; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; moderate effervescence; moderately alkaline (pH 8.0); clear smooth boundary.

A22 2.5 to 7.5 cm. (1 to 3 inches); Light gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak thin platy structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; violent effervescence; strongly alkaline (pH 8.8); abrupt smooth boundary.

B2t 7.5 to 20 cm. (3 to 8 inches); Pale brown (10YR 6/3) light clay loam, grayish brown (2.5Y 5/2) moist; moderate medium columnar structure parting to moderate medium angular blocky; hard, firm, sticky, plastic; few fine and medium roots; common thin clay films on faces of peds; violent effervescence; very strongly alkaline (pH 9.4); clear smooth boundary.

B3tca 20 to 33 cm. (8 to 13 inches); Olive (5Y 5/3) Light clay loam with light gray (5Y 7/2) spots of calcium carbonate, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse angular blocky structure; hard, firm, sticky, plastic; few fine and medium roots; few thin clay films on faces of peds; common fine threads and soft masses of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.4); clear smooth boundary.

Ccacs 33 to 61 cm. (13 to 24 inches); Light brownish gray (2.5Y 6/2) light clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, firm, sticky, plastic; few medium roots; many fine and medium threads and soft masses of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.4); gradual wavy boundary.

Cr 61 cm. (24 inches); Soft, gypsiferous sandy shale.

KINNEAR VARIANT loam (Sheldon Gulch Exclosure).
Taxonomic Class: Fine-silty, mixed, mesic Typic Camborthids.
Location: Sheldon Gulch Exclosure; Big Horn County, Wyoming; NW¼, NE¼, Sec. 33, T.52N., R.91W.
Climate: Annual precipitation is 7.36 inches, based on 10 years' data at the site. Mean annual soil temperature is about 50°F. The frost-free season is about 120 days, and the elevation is 4,585 feet.
Vegetation and Land Use: Gardner saltbush, winterfat, Indian ricegrass, and halogeton. Used for grazing.
Parent Material: Slopewash alluvium from redbeds.
Physiography: Nearly level alluvial fan.
Drainage: Well drained.
Moisture: Profile was dry to 60 inches when described.
Groundwater: None within 5 feet.
Erosion: Moderate.
Permeability: Moderately permeable.
Sampled by: D. Trueblood, D. Samuelson, J. Stephens.
Described by: J. Stephens, 8/11/78.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 5 cm. (0 to 2 inches) Light brown (7.5YR 6/4) loam, reddish brown (5YR 4/4) moist; weak thick platy structure, 1/2-inch vesicular crust on the surface; slightly hard, friable, slightly sticky, slightly plastic; very few fine roots; violent effervescence; strongly alkaline (pH 8.8); clear smooth boundary.

B21ca 5 to 23 cm. (2 to 9 inches) Reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak medium angular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and fine roots; common fine specks and threads of calcium carbonate; violent effervescence; strongly alkaline (pH 8.6); clear smooth boundary.

B22ca 23 to 40 cm. (9 to 16 inches) Light reddish brown (5YR 6/3) silt loam, reddish brown (5YR 4/4) moist; weak coarse angular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; very few fine and medium roots; common fine and medium soft masses of calcium carbonate; 5 percent gravel; violent effervescence; moderately alkaline (pH 8.4); clear wavy boundary.

C1ca 40 to 66 cm. (16 to 26 inches) Yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; massive; soft, very friable, slightly sticky, slightly plastic; very few medium roots; common fine and medium soft masses of calcium carbonate; violent effervescence; strongly alkaline (pH 8.4); clear smooth boundary.

C2cacs 66 to 109 cm. (26 to 43 inches) Light brown (7.5YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; massive; soft, very friable, slightly sticky, slightly plastic; few clusters of roots in rodent burrows; common fine soft masses and few fine threads of calcium carbonate; few coarse crystals of calcium sulfate; violent effervescence; moderately alkaline (pH 8.0); gradual wavy boundary.

C3cacs 109 to 153 cm. (43 to 60 inches) Light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 5/4) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few fine soft masses of calcium carbonate and common nests of calcium sulfate crystals; violent effervescence; moderately alkaline (pH 8.0).

ABSTED fine sandy loam, dry variant (Smilo exclosure)
Soil Family: Haplic Natrargids, fine, montmorillonitic, mesic
Location: Smilo exclosure, Washakie county, SW¼, SE¼, Sec. 14, T 45N, R 91W
Climate: Annual precipitation is 5 to 9 inches. Mean annual soil temperature is 49 to 50°F. Frost-free season is 110 to 130 days.
Vegetation and Land Use: Big sagebrush, western wheatgrass, needleandthread; grazing
Parent Material: fine textured sediments from alkaline shales and sandstones
Physiography: upland slopes, 3 to 10 percent
Drainage: well drained
Permeability: Slow
Described by: C. Fowkes, 1971

A11 0-2" Grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky, nonplastic; noncalcareous; mildly alkaline, pH 7.5 (P.R.); abrupt smooth boundary.

A2 2-4" Light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse and medium platy structure; soft, very friable, nonsticky, nonplastic; common micro, very fine, and fine roots; noncalcareous; moderately alkaline, pH 7.8 (P.R.); abrupt smooth boundary.

B2t 4-11" Brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; strong medium columnar parting to strong medium and fine angular blocky structure; very hard, very firm, very sticky, plastic; common roots all sizes; few micro, very fine, and fine pores; thin continuous and moderately thick patchy glossy coatings on all ped faces; noncalcareous; strongly alkaline, pH 8.4 (T.B.); clear smooth boundary.

B31ca 11-14" Brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) moist; moderate medium prismatic parting to moderate medium angular blocky structure; very hard, very firm, very sticky, plastic; common micro, very fine, and fine, few medium roots; common micro, very fine, and fine pores; thin patchy glossy coatings on some ped faces; calcareous; few fine soft concretions, threads, and seams of calcium carbonate; strongly alkaline, pH 8.8 (T.B.); clear wavy boundary.

B32ca 14-21" Light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; hard, firm, sticky, plastic; few fine and medium roots; common micro, very fine, and fine pores; few thin patches of glossy coatings on some ped faces; calcareous; many medium and fine streaks and threads of calcium carbonate; very strongly alkaline, pH 9.0 (T.B.); gradual wavy boundary.

C1ca 21-35" Light gray (10YR 7/2) sandy clay loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common micro, very fine, and fine pores; calcareous; common medium and fine soft concretions, streaks, and seams of calcium carbonate; very strongly alkaline, pH 9.2 (T.B.); gradual wavy boundary.

C2ca 35-46" Light yellowish brown (2.5Y 6/3) fine sandy clay loam, light olive brown (2.5Y 5/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common micro, very fine, and fine pores; calcareous; few medium and fine threads and seams of calcium carbonate; strongly alkaline, pH 8.4 (T.B.); gradual wavy boundary.

11C3 46"+ Weathered soft olive sandstone.

Remarks: Overland flow evident. Puddling, "slick spots" cover 30 to 50 percent of the surface, devoid of vegetation. Cooperative range-soil study with the Range Department of University of Wyoming. This pedon was described at the Smilo exclosure.

EFFINGTON loam (Tolman Ridge exclosure)
Soil Family: Typic Natrargids, fine, montmorillonitic, mesic.
Location: Tolman Ridge exclosure, Washakie County; NW¼, Sec. 18, T.48N., R.91W.
Climate: Eight-year average precipitation is 6.45 inches. Mean annual soil temperature is about 51°F. Frost-free season is over 120 days. Elevation is 4,380 feet.
Vegetation and Use: Bottlebrush squirreltail, Gardner saltbush, Sandberg bluegrass; use is for grazing in the area outside the exclosure.
Parent Material: Alluvium and slopewash mantle over shale.
Physiography: Upland footslope.
Drainage: Well drained.
Moisture: Profile was dry throughout when described.
Groundwater: None within 5 feet.
Erosion: Moderate.
Permeability: Slow.
Sampled by: H. Fisser, J. Stephens, L. Young, C. McAfee.
Described by: J. R. Stephens; 7/13/77.
(Colors are for air-dry soil unless otherwise noted.)

A21 0 to 7.5 cm. (0 to 3 inches); Light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; porous crust parting to weak fine and medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; few fine medium and coarse roots; mildly alkaline (pH 7.6); clear smooth boundary.

A22 7.5 to 15 cm. (3 to 6 inches); Grayish brown (10YR 5/2) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium platy structure parting to weak fine angular blocks; slightly hard, friable, slightly sticky, slightly plastic; few fine medium and coarse roots; moderately alkaline (pH 8.0); abrupt smooth boundary.

B21t 15 to 36 cm. (6 to 14 inches); Grayish brown (2.5Y 5/2) light sandy clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium angular blocky; hard, firm, sticky, plastic; very few medium and coarse roots; common thin waxy coatings on faces of peds; occasional fine thread of calcium carbonate; moderate effervescence; very strongly alkaline (pH 9.0); clear smooth boundary.

B22t 36 to 61 cm. (14 to 24 inches); Brown (10YR 5/3) light sandy clay, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky, plastic; very few medium and coarse roots; common thin waxy coatings on faces of peds and in root channels; occasional fine thread of calcium carbonate; moderate effervescence; very strongly alkaline (pH 9.0); clear smooth boundary.

B3tcacs 61 to 91 cm. (24 to 36 inches); Pale brown (10YR 6/3) heavy sandy clay loam, grayish brown (10YR 5/2) moist; weak fine and medium angular blocky structure; extremely hard, firm, sticky, plastic; few thin waxy coatings on faces of peds; common fine and medium seams of calcium carbonate; few medium soft masses of calcium sulfate crystals; moderate effervescence; strongly alkaline (pH 8.8); clear smooth boundary.

Ccacs 91 to 140 cm. (36 to 55 inches); Pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; extremely hard, firm, sticky, plastic; common fine and medium seams of calcium carbonate; common medium and coarse soft masses of calcium sulfate crystals; moderate effervescence; strongly alkaline (pH 8.8); gradual wavy boundary.

Cr 140 cm. (55 inches); Soft, gray, calcareous shale.

EFFINGTON loam (Two Mile Hill exclosure)
Soil Family: Typic Natrargids, fine, montmorillonitic, mesic.
Location: Two Mile Hill exclosure; Washakie County; SE¼, NE¼, Sec. 3, T.46N., R.89W.
Climate: Mean annual precipitation is 9.36 inches based on 14 years' data. Mean annual soil temperature is about 51°F. Frost-free season is 110 to 140 days. Elevation is 4,700 feet.
Vegetation and Land Use: Gardner saltbush, crested wheatgrass, bottlebrush squirreltail; use outside of exclosure is grazing.
Parent Material: Locally transported alluvium and slopewash from shale.
Physiography: Gently sloping footslope.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: More than 5 feet.
Erosion: Moderate.
Permeability: Slow.
Sampled by: J. R. Stephens
Described by: J. R. Stephens; 6/29/77.
(Colors are for air-dry soil unless otherwise noted.)

A11 0 to 5 cm. (0 to 2 inches); Light brownish gray (2.5Y 6/2) loam, dark grayish brown (10YR 4/2) moist; vesicular crust parting to weak coarse granular structure; slightly hard, friable, slightly sticky, slightly plastic; few fine and medium roots; slight effervescence; mildly alkaline (pH 7.8); clear smooth boundary.

A12 5 to 10 cm. (2 to 4 inches); Grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; slightly hard, firm, sticky, plastic; few fine and medium roots; moderate effervescence; moderately alkaline (pH 8.0); abrupt smooth boundary.

B21t 10 to 25 cm. (4 to 10 inches); Grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium angular blocky structure; hard, firm, very sticky, very plastic; very few medium roots; many polished pressure faces, few thin patchy clay films on faces of peds; moderate effervescence; very strongly alkaline (pH 9.0); clear smooth boundary.

B22t 25 to 59 cm. (10 to 23 inches); Grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky, very plastic; very few to occasional medium roots; many polished pressure faces and common thin clay films on faces of peds; violent effervescence; very strongly alkaline (pH 9.2); gradual wavy boundary.

B3t 59 to 81 cm. (23 to 32 inches); Grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium angular blocky structure; extremely hard, firm, sticky, plastic; few polished pressure faces and few thin clay films on faces of peds; violent effervescence; very strongly alkaline (pH 9.0); gradual wavy boundary.

Ccacs 81 to 122 cm. (32 to 48 inches); Light brownish gray (2.5Y 6/2) with white (2.5Y 8/2) calcium carbonate mottling; silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, firm, sticky, plastic; many fine and medium threads of calcium carbonate and soft masses of calcium sulfate; violent effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

Cr 122 cm. (48 inches); Soft, calcareous, alkaline shale.

Larkson loam (Upper Enos Creek Exclosure).
Taxonomic Class: Fine, montmorillonitic Typic Eutroboralfs.
Location: Upper Enos Creek exclosure; Hot Springs County, Wyoming; SW1/4, NE1/4, Sec. 31, T.46N., R.100W.
Climate: Annual precipitation is 15.49 inches, based on 8 years site data. Mean annual soil temperature is about 45°F. The frost-free season is about 90 days, and the elevation is 6,900 feet.
Vegetation and Land Use: Western wheatgrass, Idaho fiscue, big sagebrush, juniper; used for grazing.
Parent Material: Slopewash alluvium.
Physiography: Alluvial fan, gently sloping.
Drainage: Well drained.
Moisture: Profile was dry to 38 inches and moist from 38 to 60 inches when described.
Groundwater: None within 5 feet.
Erosion: Slight.
Permeability: Moderately slow.
Sampled By: D. Trueblood, D. Samuelson, J. Bell, R. Kail, J. Stephens.
Described By: J. Stephens and D. Samuelson; 8-9-78.
(Colors are for air-dry soil unless otherwise noted).

01 5 to 0 cm. (2 to 0 inch) Organic mat of decayed grass litter.

A2 0 to 8 cm. (0 to 3 inches) Light gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium and few coarse roots; neutral (pH 6.6); abrupt smooth boundary.

A&B 8 to 23 cm. (3 to 9 inches) Brown (10YR 5/3) with patches of light gray (10YR 7/2) A2 material; clay loam, dark grayish brown (10YR 4/2) mixed moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, firm, sticky, plastic; few medium and coarse roots; common thin clay films on faces of peds; many patches of A2 material; neutral (pH 6.8); clear smooth boundary.

B21t 23 to 38 cm. (9 to 15 inches) Grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium angular blocks; extremely hard, very firm, sticky, plastic; few coarse roots; thin nearly continuous clay films on faces of peds; neutral (pH 7.0); clear smooth boundary.

B22t 38 to 71 cm. (15 to 28 inches) Grayish brown (10YR 5/2) heavy clay loam, dark grayish brown (10YR 4/2) moist; strong fine and medium prismatic structure parting to strong fine and medium angular blocks; extremely hard, very firm, sticky, plastic; very few coarse roots; thin nearly continuous clay films on faces of peds with patches of moderately thick clay films; contains thin inconsistent bands of old A2 materials 1/2 to 2 inches thick, and thin inconsistent bands of very dark grayish brown (10YR 3/2) loam that are 1 to 2½ inches thick; neutral (pH 7.0); gradual wavy boundary.

B23t 71 to 97 cm. (28 to 38 inches) Brown (10YR 5/3) silty clay, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to moderate medium angular blocky; extremely hard, very firm, very sticky, very plastic; many moderately thick clay films on faces of peds, and few thick clay films in old root channels; neutral (pH 7.2); gradual wavy boundary.

C 97 to 153 cm. (38 to 60 inches) Light yellowish brown (10YR 6/3) silty clay, dark brown (10YR 4/3) moist; massive; hard, firm, sticky, plastic; weak effervescence in inconsistent spots; neutral matrix (pH 7.2) and moderately alkaline spots (pH 8.2).

Youga loam (Upper Grass Creek Exclosure).
Taxonomic Class: Fine-loamy, mixed Argic Cryoborolls.
Location: Upper Grass Creek exclosure; Hot Springs County, Wyoming; NE1/4, SE1/4, Sec. 14, T.45N., R.101W.
Climate: Annual precipitation is about 17 inches. Mean annual soil temperature is about 43°F. The frost-free season is less than 90 days, and the elevation is 7,250 feet.
Vegetation and Land Use: Limber pine, big sagebrush, lupine, and western wheatgrass. Used for grazing.
Parent Material: Slopewash alluvium.
Physiography: Gently sloping alluvial fan.
Drainage: Well drained.
Moisture: Profile was slightly moist to 23 inches when described.
Groundwater: None within 5 feet.
Erosion: Slight.
Permeability: Moderate.
Sampled By: H. Fisser, D. Trueblood, D. Samuelson, J. Bell, R. Kail, J. Stephens.
Described By: J. Stephens, D. Trueblood; 8-8-78.
(Colors are for air-dry soil unless otherwise noted).

A11 0 to 5 cm. (0 to 2 inches) Dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; moderate medium and coarse granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; neutral (pH 7.0); clear smooth boundary.

A12 5 to 13 cm. (2 to 5 inches) Dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium and few coarse roots; neutral (pH 7.0); clear smooth boundary.

B1 13 to 23 cm. (5 to 9 inches) Dark grayish brown (10YR 4/2) light clay loam, very dark gray (10YR 3/1) moist; moderate fine and medium angular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium and few coarse roots; very few thin patchy clay films that are inconsistent; 10 percent 4- to 8-inch sandstone channers; neutral (pH 7.2); clear smooth boundary.

B21t 23 to 58 cm. (9 to 23 inches) Brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; slightly hard, firm, sticky, plastic; few medium and coarse roots; thin nearly continuous clay films on faces of peds; neutral (pH 7.2); gradual wavy boundary.

B22t 58 to 99 cm. (23 to 39 inches) Brown (10YR 5/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium angular blocky structure; slightly hard, friable, sticky, plastic; few coarse roots; common thin patchy clay films on vertical faces of peds and clay bridges between sand grains; mildly alkaline (pH 7.4); gradual wavy boundary.

C1 99 to 153 cm. (39 to 60 inches) Pale brown (10YR 6/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, sticky, plastic; very few weakly effervescent spots in noneffervescent matrix; mildly alkaline (pH 7.4).

Ryan Park Variant, sandy loam (Upper Left Hand Creek).
Taxonomic Class: Coarse-loamy, mixed Borollic Haplargids.
Location: Upper Left Hand Creek exclosure; Hot Springs County, Wyoming; NW1/4, SW1/4, Sec. 12, T.46N., R.100W.
Climate: Annual precipiation is about 13 inches. Mean annual soil temperature is about 46°F. The frost-free season is about 110 days and the elevation is 6,180 feet.
Vegetation and Land Use: Big sagebrush, spiked wheatgrass, bluebunch wheatgrass, needleandthread, juniper; used for grazing.
Parent Material: Slopewash alluvium.
Physiography: Moderately sloping alluvial fan.
Drainage: Well drained.
Moisture: Profile was dry to 60 inches when described.
Groundwater: None within 6 feet.
Erosion: Slight.
Permeability: Moderately rapid.
Sampled By: D. Trueblood, D. Samuelson, J. Bell, R. Kail, J. Stephens.
Described By: J. Stephens and D. Samuelson; 8-9-78.
(Colors are for air-dry soil unless otherwise noted).

A1 0 to 10 cm. (0 to 4 inches) Grayish brown (10YR 5/2) sandy loam, dark brown (10YR 4/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and very fine roots; neutral (pH 7.0); clear smooth boundary.

B2t 10 to 35 cm. (4 to 14 inches) Brown (10YR 5/3) heavy sandy loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak fine and medium angular blocky; slightly hard, friable, slightly sticky, slightly plastic; many very fine, fine, and medium roots; few thin patchy clay films on faces of peds, and common clay bridging between sand grains; 10 percent cobble, 5 percent gravel; neutral (pH 7.2); clear smooth boundary.

C1 35 to 51 cm. (14 to 20 inches) Pale brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; massive; loose, nonsticky, nonplastic; clusters or bunches of very fine, fine, and medium roots; 40 percent gravel, 5 percent cobble; violent effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

C2 51 to 81 cm. (20 to 32 inches) Brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; massive; loose, nonsticky, nonplastic; common fine and medium roots; 20 percent gravel, 20 percent cobble, 10 percent stones; violent effervescence; moderately alkaline (pH 8.4); gradual wavy boundary.

C3 81 to 153 cm. (32 to 60 inches) Light brownish gray (10YR 6/2) gravelly sand, grayish brown (10YR 5/2) moist; single grained; loose, nonsticky, nonplastic; 30 percent gravel, 20 percent cobble, 10 percent stones; violent effervescence; moderately alkaline (pH 8.4).

MEETEETSE fine sandy loam variant (West Pasture exclosure)
Soil Family: Typic Natrargids, fine, montmorillonitic, mesic.
Location: West Pasture exclosure, Washakie County; NE¼, SW¼, Sec. 12, T.49N., R.96W.
Climate: Mean annual precipitation is 5.51 inches based on 13-years' data. Mean annual soil temperature is about 51°F. Frost-free season is 110 to 140 days. Elevation is 4,599 feet.
Vegetation and Land Use: Gardner saltbush, birdfoot sagebrush, Indian ricegrass, bud sagebrush; used for grazing.
Parent Material: Interbedded sandstone and shale.
Physiography: Upland hillsides.
Drainage: Well drained.
Moisture: Profile was dry throughout when described.
Groundwater: None more than 5 feet.
Erosion: Slight.
Permeability: Slow.
Sampled by: H. Fisser, J. Stephens, J. Orpet, L. Young, K. Spaeth, D. Viktorin.
Described by: J. R. Stephens; 6/1/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 5 cm. (0 to 2 inches); Pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; vesicular crust; soft, very friable, slightly sticky, slightly plastic; few medium and coarse roots; weak effervescence; moderately alkaline (pH 8.2); clear smooth boundary.

A2 5 to 10 cm. (2 to 4 inches); Light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine platy parting to weak fine granular structure; soft, friable, slightly sticky, plastic; few medium and coarse roots; weak effervescence; moderately alkaline (pH 8.4); clear smooth boundary.

B21t 10 to 25 cm. (4 to 10 inches); Brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; moderate medium and coarse columnar structure parting to moderate medium and coarse angular blocky; extremely hard, very firm, sticky, plastic; few medium and coarse roots; common thin clay films on faces of peds; moderate effervescence; very strongly alkaline (pH 9.4); clear smooth boundary.

B22t 25 to 36 cm. (10 to 14 inches); Brown (7.5YR 5/4) heavy clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium angular blocky structure; extremely hard, very firm, sticky, plastic; few coarse roots; common thin clay films on faces of peds; moderate effervescence; very strongly alkaline (pH 9.4); clear wavy boundary.

B23t 36 to 51 cm. (14 to 21 inches); Reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak fine and medium angular blocky structure; hard, firm, sticky, plastic; few coarse roots; few thin patchy clay films on faces of peds; moderate effervescence; very strongly alkaline (pH 9.2); gradual wavy boundary.

Cca 51 to 76 cm. (21 to 30 inches); Light brown (7.5YR 6/4) sandy loam, dark brown (7.5YR 4/4) moist; massive; very few coarse roots; slightly hard, friable, slightly sticky, slightly plastic; many fine specks and threads of calcium carbonate; violent effervescence; moderately alkaline (pH 8.2); gradual wavy boundary.

Cr 76 cm. (30 inches); Reddish brown, calcareous sandstone.

BRIBUTTE silty clay loam (Willwood exclosure)
Soil Family: Typic Torriorthents, clayey, montmorillonitic (calcareous), mesic, shallow.
Location: Willwood exclosure, Washakie County; NE¼, SE¼, Sec. 22, T.48N., R.95W.
Climate: Mean annual precipitation is 6.04 inches based on 14-years' data. Mean annual soil temperature is about 50°F., frost-free season is 110 to 140 days; elevation is 4,465 feet.
Vegetation and Land Use: Gardner saltbush, Indian ricegrass; used for grazing.
Parent Material: Formed in residuum from calcareous, platy shale.
Physiography: Gently sloping to rolling uplands.
Drainage: Well drained.
Moisture: Profile was dry when sampled.
Groundwater: None, more than 5 feet.
Erosion: Moderate.
Permeability: Slow.
Sampled by: J. Stephens, H. Fisser, J. Orpet, K. Spaeth, D. Viktorin; 5/31/77.
Described by J. R. Stephens; 5/31/77.
(Colors are for air-dry soil unless otherwise noted.)

A1 0 to 1.5 cm. (0 to 1/2 inch); Reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak fine angular blocky structure; hard, firm, sticky, plastic; very few very fine roots; moderate effervescence; very strongly alkaline (pH 9.2); clear smooth boundary.

C 1.5 to 12 cm. (1/2 to 5 inches); Reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; massive; extremely hard, very firm, sticky, plastic; very few fine and very fine roots; moderate effervescence; very strongly alkaline (pH 9.4); gradual wavy boundary.

Cr1 12 to 23 cm. (5 to 9 inches); Soft, calcareous, platy shale.

Cr2 23 cm. (9 inches); Hard, platy shale; estimated hardness of 2.5 on Mohs scale.

Oceanet Variant sandy loam (Worland Cattle Company, Ridgetop).
Taxonomic Classification: Loamy, mixed (nonacid), mesic, shallow Typic Torriorthents.
Location: Worland Cattle Company exclosure; Washakie County, Wyoming; NE1/4, NE1/4, Sec. 8, T.45N., R.92W.
Climate: Annual precipitation is 7.72 inches, based on 10 years' of data. Mean annual soil temperature is about 51°F.; frost-free season is over 120 days. Elevation is 4,400 feet.
Vegetation and Land Use: Big sagebrush, cactus, cheatgrass; used for grazing.
Parent Material: Residuum from non-calcareous sandstone.
Physiography: Ridgecrest.
Drainage: Excessive.
Moisture: Profile was dry to 9 inches.
Groundwater: None.
Erosion: Moderate.
Permeability: Moderately rapid.
Sampled by: H. Fisser, D. Trueblood, D. Samuelson, J. Stephens.
Described by: J. Stephens, D. Trueblood; 8-7-78.
(Colors are for air-dry soil unless otherwise noted).

A1 0 to 7 cm. (0 to 3 inches) Light gray (10YR 7/2) sandy loam, brown (10YR 5/3) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; few medium and coarse roots; neutral (pH 7.2); clear smooth boundary.

C1 7 to 23 cm. (3 to 9 inches) Brown (10YR 5/3) light sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, firm, slightly sticky, slightly plastic; few medium and coarse roots; mildly alkaline (pH 7.6); gradual wavy boundary.

C2r 23 cm. (9 inches) Soft, noncalcareous sandstone.

Muff sandy loam 1/ (Worland Cattle Company, swale position).
Taxonomic Classification: Fine-loamy, mixed, mesic Typic Natrargids.
Location: Worland Cattle Company exclosure; Washakie County, Wyoming; NE1/4, NE1/4, Sec. 8, T.45N., R92W.
Climate: Annual precipitation is 7.72 inches, based on 10 years' data. Mean annual soil temperature is about 51°F.; frost-free season is more than 120 days. Elevation is 4,400 feet.
Vegetation and Land Use: Russian thistle, cactus, cheatgrass. Used for grazing.
Parent Material: Residuum and local slopewash materials derived from strongly alkaline sandy shales.
Physiography: Gently sloping hillside.
Drainage: Well drained.
Moisture: Profile was dry when described.
Groundwater: None.
Erosion: Slight.
Permeability: Moderately slow.
Sampled By: H. Fisser, D. Trueblood, D. Samuelson, J. Stephens.
Described By: J. Stephens, D. Trueblood; 8-7-78.
(Colors are for air-dry soil unless otherwise noted).

A1 0 to 7 cm. (0 to 3 inches) Pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak coarse granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common fine and medium roots; neutral (pH 7.2); clear smooth boundary.

A2 7 to 13 cm. (3 to 5 inches) Light gray (10YR 7/2) loamy fine sand, dark brown (10YR 4/3) moist; weak coarse platy structure; slightly hard, very friable, nonsticky, nonplastic; common fine and medium roots; neutral (pH 7.2); abrupt smooth boundary.

B2t 13 to 35 cm. (5 to 14 inches) Grayish brown (10YR 5/2) clay loam, dark brown (10YR 4/3) moist; strong fine and medium columnar structure parting to strong fine and medium angular blocky; extremely hard, very firm, sticky, plastic; few medium roots; common thin and few thick patchy clay films on faces of peds; strong effervescence; strongly alkaline (pH 8.8); clear smooth boundary.

B3tca 35 to 61 cm. (14 to 24 inches) Pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak coarse angular blocky; extremely hard, firm, sticky, plastic; very few medium roots; few thin patchy clay films; many fine and medium soft masses and seams of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.2); clear smooth boundary.

1/ Considered as taxadjunct to the Muff series - depth to paralithic contact exceeds the series range by 3 inches.

C1ca 61 to 86 cm. (24 to 34 inches) Pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common medium and coarse soft masses of calcium carbonate; violent effervescence; very strongly alkaline (pH 9.0); gradual wavy boundary.

C2ca 86 to 109 cm. (34 to 43 inches) Grayish brown (10YR 5/2) loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few coarse soft masses of calcium carbonate; violent effervescence; strongly alkaline (pH 8.8); clear smooth boundary.

C3cr 109 cm. (43 inches) Soft, yellowish brown sandstone.

APPENDIX B

SOIL CHEMICAL ANALYSES

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LAB ANALYSIS FOR Basin Flat Exclosure (ARTR Type)

ROOTING DEPTH 16"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A11	0-4	1.2	61	30	9	58.6	1.13	8.5	8.8	1.20
A12	4-8	1.7	49	35	16	46.4	1.11	8.8	10.1	.65
C1	8-16	6.4	52	30	18	36.4	1.36	8.6	9.9	4.20
Cr	16+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A11	1.3	1.5	16.1	5.6	10.5	17.6	5.8	11.8
A12	.3	3.0	16.2	6.4	9.8	17.1	6.6	10.5
C1	.5	3.0	16.1	7.1	9.0	23.6	7.3	16.3
Cr								

LAB ANALYSES FOR Basin Flat Exclosure (ARTR Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A11	8.9	0	.3	.1	.1	.1	.6	5.4	2.0	.9
A12	12.1	0	.1	0	0	0	.1	5.0	3.9	3.0
C1	12.5	0	2.4	.1	.1	0	0	5.9	3.8	7.0
Cr										

LAB ANALYSIS FOR Basin Flat Exclosure (ATGA Type)

ROOTING DEPTH 20"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-6	.1	56	35	9	46.6	1.09	8.8	9.4	.85
B21tcacs	6-14	.1	39	26	35	30.8	1.33	8.7	10.0	6.20
B3tcacs	14-20	.1	23	72	5	20.4	1.35	8.4	8.8	26.20
Cr	20+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.8	2.0	8.2	4.1	4.1	11.5	4.5	7.0
B21tcacs	1.2	5.0	28.4	9.5	18.9	47.8	15.2	32.6
B3tcacs	.8	2.0	32.0	10.3	21.7	36.1	13.0	23.1
Cr								

LAB ANALYSES FOR Basin Flat Exclosure (ATGA Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	8.9	0	.2	0	0	0	.3	4.5	1.9	1.8
B21tcacs	23.8	0	3.6	.1	.1	0	0	5.9	4.3	31.0
B3tcacs	19.6	49.0	9.2	.9	1.2	0	0	44.1	5.4	33.0

LAB ANALYSIS FOR Big Bend Exclosure

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	.1	41	44	15	29.0	1.18	7.0	7.6	1.00
B21t	3-7	.1	34	40	26	25.0	1.13	7.1	8.0	.34
B22t	7-11	0	35	34	31	23.2	1.14	7.5	8.3	.90
B3tca	11-22	.1	36	35	29	24.0	1.14	8.6	9.3	.62
C1ca	22-38	.3	38	33	29	25.4	1.25	9.0	10.2	1.15
C2ca	38-60	.2	41	30	29	25.4	1.07	9.2	9.6	6.90

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	4.1	1.5	15.0	8.7	7.7	21.8	9.0	11.8
B21t	1.5	1.0	18.1	7.6	10.5	22.7	9.3	12.4
B22t	1.1	.5	17.9	7.4	10.5	24.2	10.3	13.9
B3tca	.7	10.5	24.6	9.9	14.7	22.9	9.3	13.6
C1ca	.7	8.5	22.9	9.2	13.7	33.4	11.4	22.0
C2ca	.3	4.5	21.8	8.3	13.5	31.4	11.6	19.8

LAB ANALYSES FOR Big Bend Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	14.5	0	0	.2	.1	0	.7	4.3	2.8	.1
B21t	22.0	0	0	.1	.1	0	.9	6.5	5.1	.1
B22t	23.8	0	0	.1	.1	0	.6	9.3	6.4	.2
B3tca	42.7	0	.1	.1	.1	0	.3	7.5	8.2	1.0
C1ca	19.5	0	.5	0	0	0	0	3.0	13.1	5.0
C2ca	18.4	0	3.4	.1	.7	0	0	2.4	14.9	10.0

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LAB ANALYSIS FOR Big Flat Exclosure

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-4	.2	34	43	23	14.0	1.13	8.7	9.7	1.90
C1ca	4-12	.1	33	37	30	15.2	1.33	8.2	9.6	1.80
C2ca	12-20	.1	37	30	33	14.4	1.37	8.3	8.8	7.00
C3ca	20-32	0	40	56	4	16.6	1.31	7.7	8.1	7.00
IICca	32-45	.4	48	34	18	25.4	1.12	8.1	8.9	6.00
IIC	45-60	1.1	73	14	13	23.0	1.09	8.3	8.4	5.50

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	2.3	3.0	30.1	14.2	15.9	32.4	15.0	17.4
C1ca	.4	5.5	25.7	12.7	13.1	26.3	13.0	13.3
C2ca	1.1	4.5	31.1	15.0	16.1	34.4	15.1	9.3
C3ca	.6	4.0	27.3	12.8	14.5	22.3	13.2	9.1
IICca	.2	4.0	18.3	8.2	10.1	16.2	8.1	8.1
IIC	.35	2.5	16.7	8.0	8.7	16.0	8.0	8.0

LAB ANALYSES FOR Big Flat Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	17.1	0	.5	.1	0	0	.5	8.4	3.4	4.0
C1ca	24.1	0	.8	.1	0	0	0	9.4	4.5	8.6
C2ca	22.0	0	2.3	1.0	.4	0	0	10.5	4.9	10.0
C3ca	23.4	12.5	2.9	2.1	.7	0	0	19.4	3.6	6.0
IICca	17.0	0	1.9	1.1	.3	0	0	7.9	2.9	5.3
IIC	10.4	0	1.6	1.7	.5	0	0	7.3	1.5	3.6

LAB ANALYSIS FOR Big Sage Exclosure

ROOTING DEPTH 33"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	4.7	59	26	15	27.0	1.01	7.2	7.8	.37
B21t	3-9	4.4	58	28	14	26.2	1.21	7.8	8.5	.30
B22t	9-14	12.3	28	53	19	24.0	1.25	8.4	8.9	.30
B3tca	14-19	23.6	53	26	21	20.6	1.33	8.3	8.9	.38
C1ca	19-33	24.2	59	13	28	16.8	1.30	8.4	9.4	.40
C2ca	33-60	13.1	70	13	17	17.2	1.34	8.5	9.9	

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	1.8	1.0	15.9	8.0	7.9	16.3	8.2	8.1
B21t	1.6	1.5	20.2	10.8	9.4	24.3	11.2	13.1
B22t	1.2	13.5	20.0	10.5	9.5	21.3	10.7	10.6
B3tca	1.1	14.0	17.8	7.4	10.4	18.2	7.5	10.7
C1ca	.4	24.5	20.1	11.5	8.6	27.2	12.0	15.2
C2ca	.1	11.0	13.1	5.5	7.6	13.7	5.8	7.9

LAB ANALYSES FOR Big Sage Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	16.1	0	0	.1	.1	0	.7	6.9	3.4	.2
B21t	22.9	0	0	.0	0	0	.3	10.4	4.1	.3
B22t	19.5	0	0	.2	.1	0	.2	9.8	4.2	.3
B3tca	15.4	0	.1	.1	.1	0	.1	6.9	4.9	.3
C1ca	13.2	0	.1	.1	.1	0	.1	4.4	6.0	.6
C2ca	12.9	0	.9	0	.1	0	0	4.0	5.8	4.5

LAB ANALYSIS FOR Big Sky Exclosure

ROOTING DEPTH 17"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	7.1	52	35	13	26.4	1.06	7.7	8.0	.50
B2t	3-11	6.2	44	37	19	26.6	1.27	8.0	8.7	.35
B3tca	11-17	18.4	46	33	21	22.6	1.38	8.4	8.9	.37
C1ca	17-25	11.1	50	20	30	18.8	1.53	8.8	9.6	
C2ca	25-34	32.4	59	14	27	14.6	1.26	9.3	10.0	.78
C3ca	34-60	41.7	56	18	26	17.4	1.15	9.0	10.0	.87

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	2.9	0	12.4	8.4	4.0	16.8	10.3	6.5
B2t	1.5	3.5	16.6	10.0	6.6	19.4	11.1	8.3
B3tca	1.4	14.5	24.1	13.0	11.1	32.5	13.7	18.8
C1ca	.5	25.5	23.0	9.1	13.9	23.4	9.9	13.5
C2ca	.4	34.0	22.0	10.1	11.9	25.0	10.3	14.7
C3ca	.4	26.5	19.1	8.4	10.7	22.1	9.4	12.7

LAB ANALYSES FOR Big Sky Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	20.9	0	0	.1	.1	0	.8	8.4	3.7	.6
B2t	23.6	0	0	.1	.1	0	.3	10.9	4.1	.3
B3tca	18.9	0	0	.1	.1	0	.2	9.9	5.6	.3
C1ca	12.1	0	.1	.1	.1	0	0	4.5	6.4	1.0
C2ca	22.9	0	.3	0	.1	0	0	4.5	7.3	1.6
C3ca	12.0	0	.3	0	.1	0	0	2.5	8.2	2.4

LAB ANALYSIS FOR Boysen Exclosure

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-4	19.5	69	19	12	23.0	1.10	8.5	9.1	.50
B21t	4-10	2.5	56	16	28	20.8	1.31	8.8	10.0	.60
B22tca	10-17	2.2	64	16	20	14.0	1.37	9.1	10.4	1.30
B3tca	17-23	1.2	69	10	21	8.8	1.39	8.8	10.2	1.30
Cca	23-32	21.7	47	27	26	24.8	1.36	8.9	10.2	1.00
C	32+	60.5	76	10	14	12.2	1.60	8.2	8.5	4.30

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.6	4.0	16.0	4.8	11.2	20.2	5.2	15.0
B21t	.6	7.5	15.8	7.0	8.8	23.4	7.1	16.3
B22tca	.2	9.5	13.2	6.9	6.3	23.6	7.0	16.6
B3tca	0	10.0	15.0	8.1	6.9	28.7	9.0	19.7
Cca	.2	11.5	11.2	3.6	7.6	14.2	4.1	10.1
C	.3	7.0	12.9	5.5	7.4	25.4	6.3	19.1

LAB ANALYSES FOR Boysen Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	11.6	0	.1	.1	0	0	.6	7.0	1.8	.7
B21t	22.9	0	.3	.1	0	0	.4	10.4	3.5	5.0
B22tca	17.0	0	.2	0	0	0	0	5.5	2.1	7.2
B3tca	14.3	0	.3	0	0	0	0	5.5	1.7	8.6
Cca	19.7	0	.7	0	0	0	0	7.5	2.7	14.0
C	13.6	11.3	1.1	1.5	.2	0	0	21.0	1.5	4.0

LAB ANALYSIS FOR Bud Kimball Exclosure[1]

ROOTING DEPTH 40-60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A11	0-2	0	21	49	30	16.6	1.05	7.1	7.8	.7
A12	2-5	0	18	49	33	14.0	1.32	6.8	7.6	.35
B1	5-8	0	17	48	35	13.4	1.17	7.1	7.9	.37
B2t	8-13									
B2tca	13-16									
B3ca	16-27									
Cca	27-40									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A11	1.7	.6	*	*	9.11	16.08	6.97	9.11
A12	1.4	.5	*	*	8.90	16.16	7.26	8.90
B1	1.1	.5	*	*	9.60	18.09	8.49	9.60
B2t								
B2tca								
B3ca								
Cca								

1--After Ries 1973

*--Data not available

LAB ANALYSIS FOR Buffalo Basin Exclsoure

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-5	10.8	46	38	16	19.0	1.11	7.8	8.0	.80
B2	5-12	.6	30	41	29	12.0	1.20	8.2	9.1	.58
B2ca	12-19	.7	29	41	30	12.8	1.21	8.2	8.8	5.20
C1ca	19-34	.4	19	61	20	7.4	1.21	8.6	9.1	13.50
C2ca	34-60	.2	38	41	21	16.6	1.31	8.9	9.3	13.80

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	3.4	1.5	25.0	9.3	15.7	27.1	9.6	17.5
B2	2.1	1.0	25.7	8.7	17.0	29.7	9.0	20.0
B2ca	.5	3.5	25.3	8.7	16.6	28.8	9.1	19.7
C1ca	.5	14.5	20.3	9.2	11.1	23.8	9.6	14.2
C2ca	.2	7.0	24.2	8.1	16.1	26.9	8.7	18.2

LAB ANALYSES FOR Buffalo Basin Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	14.5	0	0	.2	.1	.1	2.0	5.3	2.6	.7
B2	15.2	0	.1	.1	.1	.1	1.0	7.4	4.9	.3
B2ca	11.8	0	.9	1.1	1.7	.1	.1	5.4	5.2	2.3
C1ca	38.9	0	3.4	1.3	4.9	.2	0	4.2	5.8	6.6
C2ca	7.0	0	3.9	.6	3.0	.2	0	2.4	7.7	7.9

LAB ANALYSIS FOR Buffalo Creek Exclosure[1]

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	0	28	42	30	19.5	1.23	7.0	7.9	.42
B1	2-5	0	27	34	39	17.5	1.14	7.0	7.7	.34
B2t	5-13	0	22	38	40	15.4	1.10	7.5	8.7	.73
B3ca	13-19									
C1ca	19-32									
C2	32-40									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	1.9	.5	*	*	9.25	16.95	7.70	9.25
B1	1.9	.5	*	*	11.40	22.16	10.76	11.40
B2t	.9	.7	*	*	10.24	22.16	11.92	10.24
B3ca								
C1ca								
C2								

1--After Ries 1973

*--Data not available

LAB ANALYSIS FOR Burnt Wagon Exclosure

ROOTING DEPTH 17"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-1	5.9	46	28	26	15.4	1.16	8.7	9.6	.80
B21t	1-4	2.2	34	27	39	10.6	1.28	8.7	9.7	1.50
B22t	4-10	1.1	30	26	44	9.2	1.36	8.6	9.9	3.60
C1	10-17	4.1	29	26	45	11.2	1.50	7.7	7.9	8.70
Cr	17+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.6	4.0	23.2	9.2	14.0	24.3	11.5	12.8
B21t	.4	3.0	22.6	11.0	11.6	33.6	13.0	20.6
B22t	.5	4.0	23.8	12.8	11.0	36.5	13.2	23.3
C1	.4	2.0	20.3	13.2	7.1	34.8	14.5	20.3
Cr								

LAB ANALYSES FOR Burnt Wagon Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	18.8	0	.2	0	0	0	.5	8.5	2.2	4.0
B21t	24.3	0	.4	0	0	0	.2	10.0	2.5	8.0
B22t	23.2	0	1.4	.1	0	0	0	9.4	2.8	13.0
C1	29.5	23.9	4.9	1.7	.4	0	0	48.3	2.8	16.3

LAB ANALYSIS FOR Chalk Exclosure

ROOTING DEPTH 10"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-½	1.0	68	23	9	22.2	.88	8.3	9.1	.60
A2	½-2	1.0	68	23	9	22.2	1.04	8.3	9.1	.60
B21t	2-5	0	48	27	25	20.4	1.30	8.7	9.8	1.40
B3tca	5-10	1.9	46	26	28	17.8	1.31	8.7	10.2	2.30
Cr	10+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.2	3.5	12.2	4.1	8.1	17.0	5.1	11.9
A2	.2	3.5	16.8	7.1	9.7	27.2	8.8	18.4
B21t	.1	8.0	16.6	7.0	9.6	27.1	9.2	17.9
B3tca	.1	7.0	17.0	7.3	9.7	27.5	10.3	17.2
Cr								

LAB ANALYSES FOR Chalk Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	9.1	0	.1	0	0	0	.3	5.5	1.2	1.1
A2	9.1	0	.1	0	0	0	.3	5.5	1.2	1.1
B21t	15.2	0	.5	0	0	0	0	7.0	1.7	6.3
B3tca	16.1	0	1.1	.1	0	0	0	7.0	1.8	9.6

LAB ANALYSIS FOR Cochran Exclosure[1]

ROOTING DEPTH 40-60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A11	0-2	.1	26	39	35	20.0	.97	6.9	7.2	.26
A12	2-5	.1	26	39	35	20.0	1.18	6.9	7.2	.26
B2t	5-10	.1	15	37	48	12.2	1.20	7.3	7.7	.43
B3ca	10-18									
C1ca	18-33									
C2	33-40									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A11	1.0	.5	*	*	6.08	14.53	8.44	6.09
A12	1.0	.5	*	*	6.08	14.53	8.44	6.09
B2t	1.0	.5	*	*	8.33	23.13	14.79	8.34
B3ca								
C1ca								
C2								

1--After Ries 1973

*--Data not available

LAB ANALYSIS FOR Demer Exclosure[1]

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	.2	43	35	22	24.0	.96	6.7	7.1	.52
B2t	2-7	0	36	31	33	19.8	1.31	7.3	8.1	.55
B3ca	7-12	.1	29	29	42	15.7	1.24	8.0	8.7	.70
C1ca	12-23									
C2	23-32									
C3	32-40									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	1.1	.5	*	*	5.05	8.99	3.93	5.06
B2t	1.0	.7	*	*	10.02	17.66	7.64	10.02
B3ca	.8	9.2	*	*	8.11	17.74	8.11	9.63
C1ca								
C2								
C3								

1--After Ries 1973
*--Data not available

LAB ANALYSIS FOR Dutch Nick Flat Exclosure

ROOTING DEPTH 12"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
	0-2	5.7	63	26	11	22.8	1.35	7.6	8.0	.45
	2-5	3.1	67	22	11	18.4	1.22	7.5	8.3	.35
	5-12	6.2	69	21	10	17.4	1.26	8.1	8.6	.43
	12-40	2.8	55	12	33	12.2	1.11	8.4	9.5	.60

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
	1.1	0	14.4	3.4	11.0	14.2	3.9	10.3
	.4	0	12.7	5.3	7.4	12.5	5.3	7.2
	.2	2.0	12.4	4.4	8.0	13.0	5.0	8.0
	.6	23.0	17.1	9.1	8.0	22.4	9.7	11.7

LAB ANALYSES FOR Dutch Nick Flat Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
	9.5	0	0	.1	.1	0	.6	4.4	2.3	.5
	13.4	0	0	.1	0	0	.6	5.4	2.4	.1
	11.4	0	0	.1	.1	0	.3	6.4	2.3	1.0
	17.5	0	.2	.1	.1	0	0	7.9	4.6	1.0

LAB ANALYSIS FOR East Ridge Exclosure (ARTR Type)

ROOTING DEPTH 18"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	.6	42	37	21	18.8	.92	7.4	8.0	.50
C1	2-8	.1	36	35	29	15.8	1.25	7.9	8.4	.80
Cca	8-18	0	33	36	31	12.6	1.17	8.1	8.6	
R	18+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	4.4	2.0	25.5	7.9	17.6	25.7	10.1	15.6
C1	1.6	2.0	21.2	7.8	13.4	24.0	10.6	13.4
Cca	.8	5.0	22.5	9.1	13.4	24.2	12.5	11.7
R								

LAB ANALYSES FOR East Ridge Exclosure (ARTR Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	23.8	0	0	.2	.1	.1	.2	9.8	3.6	.1
C1	22.5	0	0	.2	.1	0	1.0	11.3	4.2	.4
Cca	26.1	0	0	.1	.1	0	.4	13.4	4.0	.3

LAB ANALYSIS FOR East Ridge Exclosure (ATGA Type)

ROOTING DEPTH 25"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	1.8	44	35	21	15.0	1.06	8.2	8.8	1.40
B1	2-7	.6	36	29	35	11.8	1.29	8.9	9.6	1.30
B21t	7-12	.5	34	27	39	10.2	1.45	8.2	9.5	1.40
B22t	12-20	7.1	32	30	38	7.2	1.46	6.4	7.7	3.20
Ccacs	20-25	6.8	48	46	6	8.2	1.05	4.5	4.7	4.30
Cr	25+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	2.8	3.0	28.2	10.7	17.5	33.3	12.3	21.0
B1	1.6	4.5	28.1	10.6	17.5	33.3	12.1	21.2
B21t	1.1	5.5	30.6	10.4	20.2	34.9	11.8	23.1
B22t	1.5	2.5	30.2	11.6	18.6	32.1	13.4	18.7
Ccacs	.5	1.0	39.0	13.0	26.0	27.4	15.1	12.3
Cr								

LAB ANALYSES FOR East Ridge Exclosure (ATGA Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	20.8	0	.5	.1	0	0	.5	8.9	3.6	3.4
B1	25.9	0	.5	.1	0	0	.1	11.4	3.6	6.0
B21t	28.6	0	1.0	.3	.1	0	0	15.7	3.2	6.0
B22t	37.1	0	.7	.9	0	0	0	14.1	2.9	3.8
Ccacs	30.3	56.4	.5	.9	.3	0	0	64.1	2.6	2.9

LAB ANALYSIS FOR Grass Creek Divide Exclosure (Type A)

ROOTING DEPTH 29"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A11	0-2	.2	51	39	10	24.4	.86	6.0	6.3	.81
A12	2-8	.1	48	30	22	17.4	1.13	5.8	6.7	.35
B21t	8-20	1.7	45	26	29	17.2	1.31	6.6	7.0	.62
B22t	20-29	8.3	44	17	39	11.8	1.58	6.6	7.5	.55
Ccr	29									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A11	13.1	1.5	22.5	7.8	14.7	28.9	9.0	19.9
A12	5.4	1.0	22.3	7.3	15.0	26.7	8.3	18.4
B21t	2.9	0	16.0	5.2	11.2	28.2	6.1	22.1
B22t	2.0	1.0	20.4	5.0	15.4	26.9	5.5	21.4
Ccr								

LAB ANALYSES FOR Grass Creed Divide Exclosure (Type A)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A11	30.2	0	0	.2	.1	.1	2.0	8.8	2.4	.1
A12	24.3	0	0	0	0	.1	1.6	7.5	2.0	0
B21t	18.9	0	0	0	0	0	2.0	6.5	2.2	.2
B22t	15.4	0	.1	0	0	0	.6	5.0	2.6	.3

LAB ANALYSIS FOR Grass Creek Divide Exclosure (Type B)

ROOTING DEPTH 7"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	9.6	49	22	29	11.4	1.28	4.8	5.6	.55
B2	2-7	11.3	39	17	44	5.6	1.36	4.4	4.9	.50
Cr	7									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	5.1	.5	14.7	8.3	6.6	26.1	13.9	13.8
B2	4.7	0	22.4	12.1	10.3	25.7	14.0	11.7
Cr								

LAB ANALYSES FOR Grass Creek Divide Exclosure (B Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	33.0	0	0	.1	0	0	.4	4.5	1.4	.2
B2	34.5	0	0	0	0	0	.4	3.0	1.0	.2

LAB ANALYSIS FOR Grass Creek Divide Exclosure (Type C)

ROOTING DEPTH 24"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A2	0-3	4.6	52	28	20	16.2	.98	6.5	6.6	.48
A & B	3-7	1.1	43	24	33	13.4	1.39	6.1	6.8	.40
B1t	7-9	.2	49	10	41	3.8	1.25	6.3	7.0	.44
B21t	9-19	.1	43	17	40	10.8	1.37	6.6	7.7	.90
B22t	19-24	.3	16	24	60	1.4	1.57	6.9	7.8	.60
Ccr	24									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A2	2.2	1.5	21.9	9.3	12.6	24.6	11.2	13.4
A & B	3.3	.5	15.4	7.2	8.2	25.4	11.6	13.8
B1t	2	.5	17.1	10.1	7.0	28.3	13.0	15.3
B21t	2.3	1.5	30.1	11.1	19.0	31.0	13.7	17.3
B22t	.9	1.5	19.1	8.7	10.4	25.5	11.9	13.6
Ccr								

LAB ANALYSES FOR Grass Creek Divide Exclosure (C Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A2	23.4	0	0	.1	0	0	1.0	6.9	1.9	.3
A & B	19.8	0	0	0	0	0	1.0	6.0	2.0	.2
B1t	27.0	0	0	.1	0	0	1.0	9.4	3.7	.3
B21t	23.8	0	.1	.1	.1	0	.6	7.4	3.2	.4
B22t	30.2	0	.1	.2	.1	0	.3	10.8	5.2	.7

LAB ANALYSIS FOR Grass Creek Divide Exclosure (Type D)

ROOTING DEPTH 15"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	.3	29	17	54	6.2	1.14	6.6	7.3	.45
B2t	3-9	.6	19	17	64	3.0	1.30	7.8	8.6	.40
B3tca	9-15	2.3	25	23	52	7.2	1.36	8.0	8.9	.65
Ccr	15+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	3.3	.5	18.2	8.3	9.9	26.0	11.5	14.5
B2t	2.3	7.5	24.7	10.2	14.5	29.2	12.0	17.2
B3tca	2.3	5.0	24.2	10.1	14.1	31.6	12.3	19.3
Ccr								

LAB ANALYSES FOR Grass Creek Divide Exclosure (D Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	28.8	0	0	.1	0	0	.9	9.9	3.9	.4
B2t	28.2	0	.1	.1	.1	0	.4	12.4	4.6	.5
B3tca	18.2	0	.1	.1	.1	0	.2	15.9	6.4	.9

LAB ANALYSIS FOR Halogeton Exclosure #1 (East Site)

ROOTING DEPTH 42"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A2	0-2	.2	51	25	24	15.2	1.20	8.4	9.9	.50
B21t	2-10	.1	53	24	23	14.4	1.37	8.2	9.8	3.40
B22t	10-18	.1	60	20	20	18.0	1.33	8.2	9.7	
B23tca	18-29	.1	52	27	21	14.8	1.35	8.4	9.4	3.20
C1ca	29-42	0	59	23	18	20.4	1.48	8.4	9.6	3.00
C2cr	42+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A2	1.1	3.0	20.3	4.4	15.9	20.9	4.6	16.3
B21t	.7	3.0	11.7	5.1	6.6	22.5	8.6	13.9
B22t	.2	2.0	16.0	6.3	9.7	17.6	7.2	10.4
B23tca	.1	2.5	14.4	6.4	8.4	19.8	7.5	12.3
C1ca	.1	1.5	20.1	4.5	15.6	14.2	4.3	9.9
C2cr								

LAB ANALYSES FOR Halogeton Exclosure #1 (East Site)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A2	15.9	0	.1	.1	0	0	.4	8.9	2.4	.6
B21t	15.7	0	1.1	.1	0	0	0	7.4	1.8	7.5
B22t	12.7	0	1.3	.1	0	0	0	5.4	1.9	6.5
B23tca	13.2	0	1.3	.1	0	0	0	5.9	2.3	5.5
C1ca	11.1	0	.9	.1	0	0	0	4.9	2.1	4.8

LAB ANALYSIS FOR Halogeton Exclosure #1 (West Site)

ROOTING DEPTH 10"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	.1	46	31	23	13.0	1.19	8.0	9.3	.60
B21t	2-5	0	48	22	30	11.0	1.15	8.6	9.5	2.70
B22t	5-10	.1	60	14	26	10.0	1.45	8.8	9.8	.80
Ccr	10+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.9	10.0	21.3	7.1	14.2	17.5	8.5	9.0
B21t	.8	3.0	21.1	7.1	14.0	26.1	9.7	16.4
B22t	.5	1.5	18.0	6.3	11.7	21.6	9.0	12.6
Ccr								

LAB ANALYSES FOR Halogeton Exclosure #1 (West Site)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	16.8	0	.1	.1	0	0	.4	9.4	2.1	.8
B21t	18.2	0	.3	.1	0	0	0	9.5	2.1	2.6
B22t	16.4	0	.4	.1	0	0	0	9.4	1.8	2.3

LAB ANALYSIS FOR Halogeton Exclosure #2

ROOTING DEPTH 48"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A21	0-3	0	46	40	14	21.6	1.26	8.1	9.5	.60
A22	3-5	.2	50	30	20	21.8	1.27	8.0	9.8	.60
B2t	5-16	.1	55	16	29	15.6	1.33	8.6	10.1	10.50
B3tca	16-23	.4	48	52	0	17.0	1.45	7.6	8.5	7.20
C1ca	23-48	1.7	62	10	28	11.4	1.34	8.1	9.3	10.50
C2cr	48+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A21	1.2	2.5	11.5	3.7	7.8	12.5	4.0	8.5
A22	.6	3.5	14.5	6.2	8.3	15.5	6.3	9.2
B2t	.8	5.5	21.3	10.2	11.1	32.0	13.8	17.8
B3tca	.2	3.5	19.2	10.0	9.2	20.9	10.4	10.5
C1ca	.5	3.0	15.3	7.1	8.2	32.6	13.6	19.0
C2cr								

LAB ANALYSES FOR Halogeton Exclosure #2

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A21	11.3	0	.2	0	0	0	.7	5.0	2.0	1.4
A22	14.1	0	.3	0	0	0	.3	7.0	3.0	2.6
B2t	18.2	0	.6	.1	0	0	0	7.0	3.1	8.0
B3tca	18.6	12.2	2.0	.9	.3	0	0	16.6	3.1	9.3
C1ca	17.1	0	3.9	.4	.3	0	0	6.6	3.4	11.0

LAB ANALYSIS FOR Halogeton Exclosure #3 (ridgetop position)

ROOTING DEPTH 18"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	0	64	18	18	11.4	1.34	7.9	8.8	.45
C1ca	3-11	.1	60	16	24	17.4	1.35	8.0	8.6	
C2ca	11-18	.1	68	11	21	22.2	1.38	7.9	8.0	3.00
C3cr	18+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	1.5	3.5	11.0	6.1	4.9	13.9	6.5	7.4
C1ca	.9	3.5	12.7	6.0	6.7	15.1	6.9	8.2
C2ca	.4	1.0	10.3	5.6	4.7	17.3	7.1	10.2
C3cr								

LAB ANALYSES FOR Halogeton Exclosure #3 (Ridgetop)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	14.3	0	0	.1	0	0	.4	7.9	1.9	.2
C1ca	17.1	0	.1	1.1	.2	0	.1	11.9	2.0	.4
C2ca	9.8	23.1	.3	1.9	.6	0	0	30.6	1.5	.8

LAB ANALYSIS FOR Halogeton Exclosure #3 (swale position)

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A2	0-3	.3	32	41	27	11.8	1.21	7.9	8.9	.81
B21t	3-12	.1	46	32	22	20.4	1.18	8.6	9.6	.50
B22tca	12-24	.1	48	21	31	15.0	1.42	8.5	9.7	.97
C1ca	24-36	0	25	73	2	15.2	1.22	8.2	8.2	7.50
C2ca	36-60	0	26	71	3	11.6	1.06	7.9	8.1	6.00

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A2	1.6	2.5	15.9	6.1	9.8	22.6	8.9	13.7
B21t	1.2	2.0	13.9	4.8	9.1	18.9	5.6	13.3
B22tca	.6	3.5	17.2	8.9	8.3	22.9	8.8	14.1
C1ca	.5	3.5	27.6	9.1	18.5	31.8	9.2	23.6
C2ca	.6	1.5	26.3	7.3	19.0	32.7	9.1	23.6

LAB ANALYSES FOR Halogeton Exclosure #3 (Swale)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A2	16.6	0	.2	.1	0	0	.5	9.3	2.3	1.1
B21t	15.0	0	.1	0	0	0	.1	7.5	2.0	2.1
B22tca	21.1	0	.4	.1	0	0	0	10.0	2.8	4.6
C1ca	17.9	19.0	2.9	2.4	.5	0	0	21.6	2.2	7.5
C2ca	19.3	11.9	2.0	1.2	.3	.1	0	18.3	2.7	8.0

LAB ANALYSIS FOR Hawk Exclosure (ATGA Type)

ROOTING DEPTH 7"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-1	5.5	48	28	24	11.2	.94	8.3	9.2	.70
C1	1-3	.4	40	23	37	11.6	1.30	8.9	10.0	.80
C2	3-7	2.7	36	27	37	12.8	1.92	8.7	8.8	1.10
Cr1	7-11	7.1	33	34	33	17.6	1.27	8.2	9.6	3.00
Cr2	11+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.2	6.0	13.2	9.9	3.3	16.6	12.0	4.6
C1	.3	4.0	20.3	11.1	9.2	27.3	13.7	13.6
C2	.1	4.0	16.2	9.4	6.8	29.6	13.8	16.0
Cr1	.3	2.5	17.5	8.3	9.2	28.3	11.5	16.8
Cr2								

LAB ANALYSES FOR Hawk Exclosure (ATGA Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	18.0	0	.2	0	0	0	.4	9.0	1.8	1.6
C1	23.2	0	.2	0	0	0	.3	10.0	2.1	6.0
C2	24.8	0	.6	0	0	0	0	10.5	2.2	7.9
Cr1	22.7	0	1.3	.1	0	0	0	9.4	2.5	9.0

LAB ANALYSIS FOR Hawk Exclosure (GRSP Type)

ROOTING DEPTH 18"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-5	.1	81	12	7	21.6	1.32	8.5	9.1	.50
C1	5-13	1.0	83	11	6	12.4	1.50	8.4	9.7	.40
IICca	13-18	.4	79	9	12	5.2	1.64	8.5	9.4	.50
IICr	18+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.7	1.0	7.1	3.3	3.8	6.8	3.2	3.6
C1	.4	1.5	12.0	3.0	9.0	7.1	3.0	4.1
IICca	.5	3.5	10.1	4.1	6.0	10.1	4.5	5.6
IICr								

LAB ANALYSES FOR Hawk Exclosure (GRSP Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	5.0	0	.1	.1	0	0	.4	3.9	1.2	.3
C1	5.7	0	.1	.1	0	0	.1	4.9	1.2	.4
IICca	8.6	0	.1	.1	0	0	0	7.4	1.0	.5

LAB ANALYSIS FOR Horse Creek Exclosure (ARNO Type)[1]

ROOTING DEPTH 19"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-4	9.8	69	26	5	33.3	1.22	7.8	7.6	1.11
AC	4-9	17.3	81	16	3	11.1	1.29	7.9	7.9	.71
CR	9-19	20.4	58	34	8	38.2	1.16	7.8	7.8	.70
R	19+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	2.2	23.8	*	*	*	*	*	*
AC	.5	50.9	*	*	*	*	*	*
CR	.6	29.2	*	*	*	*	*	*
R								

1--After Ries 1973
*--Data not available

LAB ANALYSIS FOR Horse Creek Exclosure (ARTR/AGSM Type)[1]

ROOTING DEPTH 23"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	.5	31	42	27	23.1	1.37	7.6	8.2	.65
B2	3-8	.2	25	40	35	18.8	1.39	7.7	8.3	.50
B3ca	8-17	.5	17	38	45	14.0	1.25	7.9	8.9	.55
Cca	17-23									
R	23+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	1.4	.8	*	*	7.38	15.35	7.93	7.42
B2	1.2	1.0	*	*	9.16	20.24	11.06	9.18
B3ca	1.2	8.7	*	*	9.70	22.56	12.81	9.75
Cca								
R								

1--After Ries 1973
*--Data not available

LAB ANALYSIS FOR Horse Creek Exclosure (ARTR/AGSP Type)[1]

ROOTING DEPTH 18"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	1.4	33	37	30	17.6	1.36	7.7	8.6	.50
AC	3-9	1.7	19	36	45	13.0	1.11	7.7	8.4	.45
Cca	9-18	.8	13	35	52	11.3	1.43	7.9	8.8	.60
CR	18-24									
R	24+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	1.4	9.7	*	*	8.25	17.37	9.90	8.37
AC	1.4	17.8	*	*	13.16	25.76	12.37	13.39
Cca	1.3	17.6	*	*	10.99	25.96	14.88	11.08
CR								
R								

1--After Ries 1973
*--Data not available

LAB ANALYSIS FOR Kirby Creek Exclosure

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	.1	20	50	30	7.8	1.07	8.0	8.7	.62
C1	2-13	.1	22	46	32	11.6	1.15	8.0	9.3	.70
C2	13-25	.1	19	47	34	9.0	1.36	8.4	9.8	.90
C1casa	25-48	.1	22	38	40	9.8	1.43	9.0	10.0	1.00
C2cacs	48-60									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	2.3	4.5	19.0	4.4	15.4	27.7	8.3	19.4
C1	.5	5.5	18.5	6.7	11.8	25.9	10.1	15.8
C2	.5	4.0	22.7	11.3	11.4	27.2	14.8	12.4
C1casa	.4	4.5						
C2cacs								

LAB ANALYSES FOR Kirby Creek Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	49.8	0	.1	.1	.1	.1	1.0	7.9	3.3	.4
C1	18.6	0	.3	.1	0	0	.3	9.5	3.4	2.0
C2	17.7	0	.5	0	.1	0	0	7.0	4.6	7.0
C1casa	18.6	0	.6	0	0	0	0	5.0	6.6	8.0

LAB ANALYSIS FOR Lower Enos Creek Exclosure

ROOTING DEPTH 32"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	.2	54	28	18	11.8	1.18	5.7	6.1	1.30
B21t	3-10	.4	43	24	33	7.8	1.38	6.7	7.5	.68
B22t	10-24	.1	58	17	25	8.8	1.33	7.3	8.0	.75
B3tca	24-32	8.8	66	16	18	8.0	1.36	8.1	8.9	.70
Cca	32-60	.3	77	11	12	10.6	1.38	8.4	9.2	.45

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	2.4	1.5	17.1	5.6	11.5	23.1	5.8	18.7
B21t	1.3	0	16.7	5.5	11.2	22.7	6.9	16.0
B22t	.7	1.0	15.2	6.3	8.9	20.1	7.1	13.0
B3tca	.9	2.5	12.2	6.3	5.9	12.6	7.1	5.5
Cca	.5	16.0	12.2	4.9	7.3	10.4	4.7	5.7

LAB ANALYSES FOR Lower Enos Creek Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	11.3	0	0	.2	.1	.1	.7	4.3	1.9	1.1
B21t	16.1	0	0	.1	.1	0	.3	5.9	2.9	.2
B22t	12.9	0	0	.1	.1	0	.2	5.4	3.2	.3
B3tca	10.0	0	0	.1	.1	0	.2	6.4	2.7	.9
Cca	8.6	0	0	0	0	0	.1	4.5	3.1	.2

LAB ANALYSIS FOR North Butte Relict Area[1]

ROOTING DEPTH 40-60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A11	0-2	0	25	50	25	22.9	.98	7.0	7.7	.50
A12	2-4	0	25	50	25	22.9	1.07	7.0	7.7	.50
B2t	4-7	0	16	48	36	14.8	1.20	7.1	7.7	.52
B3ca	7-13	0	13	52	35	12.3	1.20	7.7	8.5	.40
C1ca	13-29									
C2	29-40									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A11	2.1	.7	*	*	6.60	14.34	7.74	6.60
A12	2.1	.7	*	*	6.60	14.34	7.74	6.60
B2t	1.7	.5	*	*	9.36	20.04	10.68	9.36
B3ca	1.5	12.1	*	*	10.06	20.04	9.98	10.06
C1ca								
C2								

1--After Ries 1973
*--Data not available

LAB ANALYSIS FOR Potato Ridge Exclosure

ROOTING DEPTH 27"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	2.3	51	44	5	12.6	1.13	7.6	7.9	2.30
C1	2-7	8.8	74	20	6	9.6	1.19	7.7	8.4	3.00
C2	7-27	16.9	51	43	6	8.2	1.03	7.9	8.2	3.10
C3	27-33	28.3	37	61	2	12.0	*	8.5	8.7	
C4ca	33-48	9.4	55	42	3	6.8	1.14	8.6	8.8	6.50
C5ca	48-60	4.1	51	45	4	8.8	1.12	8.6	8.8	10.00

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	1.9	10.5	32.5	8.8	23.7	31.4	8.8	22.6
C1	1.2	10.5	16.8	7.3	9.5	17.0	7.2	9.8
C2	1.0	13.5	30.1	14.1	16.0	29.2	13.4	15.8
C3	.7	15.0	17.3	6.2	11.1	16.3	12.2	4.1
C4ca	.2	8.0	24.0	7.1	16.9	29.7	13.1	16.6
C5ca	.7	12.5	26.1	9.2	16.9	26.6	13.0	13.6

*--Sample Not Available

LAB ANALYSES FOR Potato Ridge Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	15.7	36.1	0	2.6	.1	.1	.7	47.4	.6	.2
C1	15.0	39.8	0	.7	.1	0	.9	64.3	2.2	.5
C2	18.0	43.0	.2	2.2	.9	0	.4	41.3	3.6	1.6
C3	16.1	55.6	1.1	2.1	4.9	.1	0	72.9	6.6	2.8
C4ca	12.0	50.6	1.2	2.1	5.3	.1	0	62.9	7.9	3.0
C5ca	12.1	55.3	1.1	1.2	4.7	.1	0	88.0	7.7	2.4

LAB ANALYSIS FOR Rankin Basin Exclosure

ROOTING DEPTH 42"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A2	0-3	.9	66	27	7	15.6	1.38	6.5	7.0	.35
B21t	3-9	.5	57	16	27	12.6	1.30	7.3	8.2	.40
B22tca	9-15	.7	56	23	21	10.6	1.43	8.2	8.9	.40
B3tca	15-29	.7	57	19	24	9.6	1.29	8.5	9.3	.70
Cca	29-42	.2	64	19	17	11.8	1.16	9.1	9.6	2.50
Cr	42+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A2	1.6	1.0	7.9	4.1	3.8	11.6	4.5	7.1
B21t	.5	.5	13.1	5.3	7.8	23.3	7.6	15.7
B22tca	.4	4.0	19.1	7.6	11.5	26.0	8.9	17.1
B3tca	.4	5.5	20.5	8.1	12.4	17.5	8.5	9.0
Cca	.6	2.5	11.9	4.2	7.7	21.8	7.1	14.7
Cr								

LAB ANALYSES FOR Rankin Basin Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A2	7.9	0	0	.1	0	0	.5	2.5	1.4	1.3
B21t	15.9	0	0	.1	0	0	.4	6.4	3.9	.3
B22tca	16.1	0	.9	.1	.1	0	0	7.9	4.4	.8
B3tca	15.4	0	.2	.1	0	0	.1	6.7	4.8	1.1
Cca	13.8	0	.4	.1	.1	0	0	5.4	4.6	1.4

LAB ANALYSIS FOR Round Top Mountain Relict Area[1]

ROOTING DEPTH 20"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A11	0-1	11.2	20	52	28	11.5	1.87	7.7	8.6	.45
A12	1-3	8.9	20	52	28	11.5	1.87	7.7	8.6	.45
AC	3-8	10.7	23	45	32	13.8	1.23	7.7	8.4	.44
C2cs	8-13	11.7	13	41	46	6.2	1.23	7.6	8.4	.65
C3cs	13-20	11.9	13	41	46	6.2	1.23	7.5	8.4	2.55
C3	20+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A11	2.9	19.0	36.7	11.2	25.5	38.2	14.1	24.1
A12	2.9	19.0	38.3	12.4	25.9	40.1	15.1	25.0
AC	2.6	16.1	36.0	10.1	26.1	36.3	12.6	23.7
C2cs	2.1	39.2	18.4	7.3	11.1	17.9	9.3	8.6
C3cs	2.1	25.6						
C3								

1--After Ries 1973

LAB ANALYSIS FOR Sand Creek Exclosure (ARSP Type)

ROOTING DEPTH 34"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	0	64	28	8	28.6	1.42	8.7	8.7	.45
A2	3-7	0	57	32	11	21.8	1.56	8.5	9.5	.60
B21tca	7-13	.2	24	42	34	15.0	1.55	8.5	9.9	1.70
B22tca	13-20	.1	53	16	31	21.2	1.47	8.5	9.9	4.80
B3tca	20-26	.1	59	16	25	21.4	1.61	8.3	9.5	6.50
Cca	26-34	.3	59	37	4	16.4	1.49	7.9	8.4	12.00
Cr	34+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.7	1.5	14.3	3.3	11.0	9.3	3.8	5.5
A2	.9	.5	17.8	7.1	10.7	19.4	7.5	11.9
B21tca	1.2	11.0	20.9	9.3	11.6	30.9	11.4	19.5
B22tca	.7	4.0	21.3	8.7	12.6	30.0	11.0	19.0
B3tca	.6	4.0	22.0	8.1	13.9	23.1	11.1	12.0
Cca	.2	1.5	16.6	5.2	11.4	22.3	8.3	14.0
Cr								

LAB ANALYSES FOR Sand Creek Exclosure (ARSP Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	8.2	0	.2	.1	.2	.1	.6	3.4	2.1	.6
A2	9.3	0	.1	0	0	0	.4	3.5	2.6	1.8
B21tca	31.4	0	.8	.1	0	0	0	9.5	5.9	9.5
B22tca	18.0	0	2.3	.2	.2	0	0	7.4	4.6	10.9
B3tca	16.8	0	3.2	.2	.2	0	0	5.8	4.2	10.0
Cca	17.1	17.6	2.7	.9	,5	0	0	24.6	4.2	12.0

LAB ANALYSIS FOR Sand Creek Exclosure (ARTR Type)

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	1.8	60	30	10	22.4	1.33	7.2	7.7	.50
B2t	3-13	.6	60	24	16	24.2	1.35	8.1	8.5	.30
B3tca	13-20	.9	56	13	31	16.2	1.74	8.9	9.6	.66
C1ca	20-30	2.3	56	25	19	18.4	1.31	8.0	8.6	6.30
IIC2ca	30-50	19.0	75	9	16	10.2	1.45	8.2	9.0	9.00
IIC3ca	50-60	13.4	69	18	13	16.2	1.29	8.0	8.7	7.00

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	1.1	1.5	13.0	10.0	3.0	18.0	13.5	4.5
B2t	.3	1.0	16.3	10.1	6.2	20.0	14.1	5.9
B3tca	.6	10.5	21.9	8.4	13.5	28.6	12.7	15.9
C1ca	.4	8.5	15.5	6.1	9.4	18.6	7.5	11.1
IIC2ca	.3	7.0	18.7	5.9	12.8	11.6	6.5	5.1
IIC3ca	.1	4.0	27.0	7.7	19.3	12.3	7.9	4.4

LAB ANALYSES FOR Sand Creek Exclosure (ARTR Type)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	11.6	0	0	.1	0	0	.7	3.9	3.1	.2
B2t	15.5	0	0	.1	.1	0	.3	6.9	4.3	.3
B3tca	16.8	0	.4	.1	0	0	0	6.4	6.1	2.9
C1ca	18.4	0	2.6	1.6	1.6	0	0	8.4	3.8	5.5
IIC2ca	10.2	0	1.6	.8	.6	0	0	6.3	3.0	6.0
IIC3ca	11.1	0	1.7	.9	.5	0	0	5.6	2.5	5.0

LAB ANALYSIS FOR Sand Gulch Exclosure

ROOTING DEPTH 24"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A21	0-1	0	34	43	23	23.0	1.15	8.3	8.6	.60
A22	1-3	.1	25	37	38	16.4	1.10	8.9	9.7	1.70
B2t	3-8	0	21	37	42	13.2	1.22	8.7	10.0	2.40
B3tca	8-13	.1	21	39	40	12.4	1.35	9.0	9.9	10.50
Ccacs	13-24	.1	16	80	4	13.4	1.16	8.6	8.9	23.00
Cr	24+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A21	1.6	8.5	16.3	8.3	8.0	19.6	11.4	8.2
A22	1.8	13.5	21.1	8.1	13.0	26.1	13.1	13.0
B2t	1.2	18.5	22.1	11.0	11.1	35.8	14.1	21.7
B3tca	1.4	15.5	24.6	7.3	17.3	34.2	14.6	19.6
Ccacs	1.3	7.5	15.0	7.1	7.9	27.4	12.4	15.0
Cr								

LAB ANALYSES FOR Sand Gulch Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A21	15.0	0	.1	.2	.1	0	1.0	8.8	3.6	.4
A22	22.9	0	.8	0	0	0	0	7.5	4.7	7.9
B2t	21.5	0	.7	0	0	0	0	6.5	5.5	12.3
B3tca	20.4	0	6.1	.4	.8	0	0	4.1	5.4	23.0
Ccacs	19.1	16.2	9.6	1.5	2.3	0	0	20.5	8.4	27.0

LAB ANALYSIS FOR Sheldon Gulch Exclosure

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	.4	28	49	23	10.2	.98	8.0	9.2	.90
B21ca	2-9	1.6	26	45	29	6.8	1.12	8.1	9.3	.50
B22ca	9-16	4.7	33	66	1	7.0	1.02	8.0	8.4	3.80
C1ca	16-26	2.8	31	66	3	9.4	1.03	8.4	8.6	12.30
C2cacs	26-43	1.1	50	44	6	8.6	1.07	8.5	8.7	15.00
C3cacs	43-60	.9	42	54	4	11.6	1.05	7.6	8.2	5.00

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	1.3	1.7	20.1	8.3	11.9	22.0	10.3	11.7
B21ca	1.4	14.5	24.0	11.1	13.9	27.1	14.3	12.8
B22ca	.9	11.5	30.5	12.3	18.2	31.5	13.6	17.9
C1ca	.8	10.5	33.6	12.7	20.9	30.7	15.4	15.3
C2cacs	.8	10.5	34.1	15.4	19.7	37.6	15.9	21.7
C3cacs	.3	9.0						

LAB ANALYSES FOR Sheldon Gulch Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	15.2	0	.1	.1	.1	.1	1.4	7.4	3.8	.6
B21ca	22.5	0	.2	.1	0	0	1.4	9.4	3.7	1.1
B22ca	20.2	49.7	.5	2.2	1.6	0	.1	57.8	3.9	1.8
C1ca	16.8	60.5	3.2	2.2	1.6	0	0	77.8	9.1	7.3
C2cacs	15.9	54.6	1.8	2.2	5.7	.1	0	57.8	10.8	4.9
C3cacs	16.3	58.3	1.4	.9	1.0	0	0	59.1	5.8	2.2

LAB ANALYSIS FOR Smilo Exclosure[1]

ROOTING DEPTH 14"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A11	0-2	.2	44	34	22	25.1	1.08	6.8	8.0	.55
A2	2-4	.1	44	34	22	25.1	1.46	6.8	8.0	.55
B2t	4-11	0	27	27	46	16.5	1.43	7.8	8.3	1.50
B31ca	11-14									
B32ca	14-21									
C1ca	21-35									
C2ca	35-46									
IIC3	46+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A11	1.0	.5	*	*	6.52	9.92	3.39	6.53
A2	1.0	.5	*	*	6.52	9.92	3.39	6.53
B2t	.9	.6	*	*	9.71	24.16	14.45	9.71
B31ca								
B32ca								
C1ca								
C2ca								
IIC3								

1--After Ries 1973
*--Data not available

LAB ANALYSIS FOR Tolman Ridge Exclosure

ROOTING DEPTH 55"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A21	0-3	.1	54	30	16	24.8	1.10	8.2	8.9	.50
A22	3-6	0	46	36	18	24.4	1.20	8.5	9.6	.55
B21t	6-14	.2	36	32	32	15.2	1.32	8.1	9.2	3.50
B22t	14-24	.1	35	32	33	15.8	1.45	8.3	9.2	8.50
B3tcacs	24-36	.3	35	31	34	16.0	1.60	8.1	8.8	9.30
Ccacs	36-55	.6	33	48	19	15.2	1.54	8.2	8.4	9.00
Cr	55+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A21	.6	1.5	16.3	4.0	12.3	20.8	4.3	16.5
A22	.5	1.0	29.0	5.1	24.1	32.0	5.4	26.6
B21t	.7	2.0	32.3	6.1	26.2	37.0	6.7	30.3
B22t	.8	5.0	21.1	4.3	16.8	25.5	5.0	20.5
B3tcacs	.4	2.0	16.7	5.3	11.4	33.5	5.1	28.4
Ccacs	.3	3.5	30.1	5.0	25.1	36.7	5.3	31.4
Cr								

LAB ANALYSES FOR Tolman Ridge Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A21	14.6	0	.1	.1	0	0	.7	5.9	3.7	.8
A22	14.3	0	.2	0	0	0	.2	6.5	2.7	2.8
B21t	25.7	0	1.4	.1	.1	0	0	8.9	4.3	9.0
B22t	25.2	0	3.3	.3	.2	0	0	9.2	5.2	11.8
B3tcacs	23.4	0	4.2	1.1	.6	0	0	10.9	4.5	10.0
Ccacs	23.9	9.2	3.0	1.3	.7	0	0	18.7	4.9	12.0

LAB ANALYSIS FOR Two Mile Hill Exclosure

ROOTING DEPTH 48"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A11	0-2	.2	30	46	24	13.0	1.19	8.1	8.8	.53
A12	2-4	0	23	34	43	9.8	1.08	8.4	9.3	.82
B21t	4-10	.1	27	31	42	10.0	1.28	8.4	9.5	.70
B22t	10-23	.1	25	30	45	7.8	1.51	8.4	9.7	.92
B3t	23-32	.2	22	33	45	7.8	1.47	8.5	9.4	4.00
Ccacs	32-48	.4	22	76	2	8.4	1.61	8.0	8.4	8.40
Cr	48+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A11	1.6	2.5	18.9	9.1	9.8	26.0	11.1	14.9
A12	1.1	4.5	20.3	9.3	11.0	32.9	8.3	24.6
B21t	1.0	6.0	21.1	7.1	14.0	33.9	17.6	16.3
B22t	.6	8.5	21.7	6.3	15.4	26.0	6.1	19.9
B3t	.8	8.0	24.7	6.9	17.8	29.3	7.6	21.7
Ccacs	.5	6.0	31.1	13.7	17.4	35.8	18.2	17.6
Cr								

LAB ANALYSES FOR Two Mile Hill Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A11	21.4	0	.1	.1	.1	0	1.2	9.4	4.1	1.0
A12	25.7	0	.4	.1	0	0	.6	9.9	5.6	3.0
B21t	25.5	0	.3	0	0	0	.4	10.0	6.7	2.8
B22t	25.7	0	.8	.1	.1	0	0	8.9	10.6	5.1
B3t	25.4	0	2.1	.2	.3	0	0	7.3	11.2	9.3
Ccacs	29.3	10.3	3.9	2.1	1.8	0	0	16.9	9.7	10.0

LAB ANALYSIS FOR Upper Enos Creek Exclosure

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
01	2-0	0	46	41	13	15.4	*	6.4	6.4	.32
A2	0-3	0	55	24	21	12.4	.98	5.9	6.4	.50
A & B	3-9	.1	53	24	23	12.0	1.27	6.3	7.1	.30
B21t	9-15	.1	60	20	20	13.0	1.35	6.3	7.0	.25
B22t	15-28	0	48	25	27	13.8	1.42	6.6	7.4	.40
B23t	28-38	.2	47	15	38	8.8	1.47	6.9	7.8	.57
C	38-60	.4	51	19	30	12.0	1.53	8.1	8.8	1.20

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
01	22.4	4.0	60.4	11.1	49.3	63.4	17.3	46.1
A2	6.1	.5	38.3	9.1	29.2	31.7	10.1	21.6
A & B	1.5	1.0	19.6	3.2	16.4	19.6	3.6	13.0
B21t	.9	5.0	13.7	5.8	7.9	16.8	7.0	9.8
B22t	1.2	.5	13.7	5.9	7.8	17.5	6.6	10.9
B23t	.8	.5	18.4	7.2	15.0	27.2	7.7	20.0
C	.8	.5	17.8	6.1	11.7	27.5	5.2	22.3

*Sample Not Available.

LAB ANALYSES FOR Upper Enos Creek Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
01	38.6	0	0	.1	.1	.2	2.0	9.4	2.6	0
A2	17.3	0	0	.1	.1	.1	1.0	4.4	1.6	.1
A&B	17.9	0	0	0	0	0	1.1	4.5	1.6	1.1
B21t	10.9	0	0	0	0	0	.9	4.5	1.6	.1
B22t	39.6	0	0	.1	0	0	.7	4.5	2.0	.2
B23t	13.9	0	.5	0	.1	.1	.1	5.0	3.7	.4
C	13.2	0	.2	.2	.2	0	.3	5.4	4.1	1.0

LAB ANALYSIS FOR Upper Grass Creek Exclosure

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A11	0-2	.3	58	31	11	17.2	1.07	6.3	6.8	.25
A12	2-5	2.4	64	21	15	14.8	1.24	6.7	6.9	.46
B1	5-9	7.2	65	22	13	15.0	1.26	6.4	7.0	.30
B21t	9-23	3.1	75	12	13	12.6	1.37	7.8	8.3	.36
B22t	23-39	.7	61	25	14	15.4	1.25	6.8	7.7	.38
C1	39-60	1.1	74	15	11	9.8	1.11	7.4	8.3	.20

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A11	11.7	1.0	26.6	11.1	15.5	19.6	13.6	6.0
A12	2.4	.5	17.2	9.2	8.0	23.8	13.1	10.7
B1	1.5	1.5	27.8	9.8	18.0	21.2	12.7	8.5
B21t	1.5	1.0	11.4	7.3	4.1	22.5	13.5	9.0
B22t	1.1	2.0	16.3	10.2	6.1	20.7	13.1	7.6
C1	0	1.5	13.1	6.1	7.0	16.4	6.9	9.5

LAB ANALYSIS FOR Upper Crane Creek Bedsheets

BORING DATE 5/__/__ PAGE 1

Sample	Depth (Ground)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Dale Toxicity (g/cc)	pH Paste	pH 1:1:5	EC (mmhos)
A12	0-1	4	56	24	16	17.5	1.06	8.3	8.6	.23
A22	1-3	2.4	66	24	10	14.8	1.39	8.7	8.8	.24
B1	3-9	1.2	84	12	4	11.0	1.59	8.4	7.8	.39
A32C	9-23	0.1	72	22	6	20.4	1.46	8.3	8.3	.28
A32R	23-39	1	80	14	6	20.2	1.39	8.4	8.7	.23
C1	39-60	2.1	76	16	8	8.8	1.42	8.4	8.3	.20

LAB ANALYSIS FOR Upper Lefthand Creek Exclosure

ROOTING DEPTH 60"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-4	11.3	65	25	10	18.2	1.15	6.7	6.9	.35
B2t	4-14	17.1	66	18	16	15.2	1.33	7.7	8.2	.50
C1	14-20	41.6	73	13	14	13.4	*	8.5	9.1	.40
C2	20-32	48.3	73	16	11	15.4	*	8.6	9.4	.30
C3	32-60	71	78	10	12	12.2	*	8.9	9.5	.38

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	2.8	1.0	6.0	2.0	4.0	6.2	2.1	4.1
B2t	1.7	.5	14.4	6.1	8.3	14.5	6.7	7.8
C1	.8	6.0	13.7	4.0	9.7	14.5	4.1	10.4
C2	.6	10.5	9.1	2.8	6.3	9.7	3.2	6.5
C3	.2	2.0	11.0	2.7	8.3	11.6	3.1	8.5

*Sample Not Available

LAB ANALYSES FOR Upper Lefthand Creek Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	8.8	0	0	.1	.1	.1	.5	3.4	1.1	.1
B2t	9.1	0	0	.2	.1	0	.4	4.8	1.3	.4
C1	4.5	0	0	.1	0	0	.2	3.9	1.5	.2
C2	4.6	0	0	.1	.1	0	.1	3.9	1.7	.2
C3	2.9	0	0	0	.2	0	.2	2,5	2.5	2.0

LAB ANALYSIS FOR West Pasture Exclosure

ROOTING DEPTH 30"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-2	.2	67	24	9	28.8	1.39	8.3	8.9	.60
A2	2-4	.2	61	21	18	22.6	1.44	8.2	9.1	.60
B21t	4-10	.1	50	18	32	16.4	1.35	9.0	10.0	1.10
B22t	10-14	0	41	21	38	18.0	1.33	8.5	9.9	2.40
B23t	14-21	0	42	24	34	20.4	1.47	8.5	10.0	3.20
Cca	21-30	1.3	57	39	4	25.6	1.36	7.7	8.3	9.00
Cr	30+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.5	2.5	12.6	5.7	6.9	18.3	7.2	11.1
A2	.3	2.0	22.2	5.9	16.3	15.5	7.4	8.1
B21t	.5	3.5	25.4	8.1	13.3	25.5	8.5	13.0
B22t	.4	4.5	24.0	5.3	18.7	22.9	6.1	16.8
B23t	.4	3.0	13.9	7.4	6.5	26.4	8.1	18.3
Cca	.2	2.5	12.5	6.6	5.9	15.8	7.1	8.7
Cr								

LAB ANALYSES FOR West Pasture Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	9.3	0	.1	.1	0	0	.7	4.4	1.8	.5
A2	10.5	0	.2	0	0	0	.5	5.0	2.0	1.2
B21t	21.8	0	.5	0	0	0	0	7.5	2.4	6.5
B22t	25.5	0	1.1	0	0	0	0	8.5	2.6	11.8
B23t	19.5	0	2.4	.1	0	0	0	7.4	2.0	11.4
Cca	13.8	10.1	2.3	.8	.2	0	0	11.3	1.4	8.4

LAB ANALYSIS FOR Willwood Exclosure

ROOTING DEPTH 5"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-½	1.3	29	39	32	13.6	1.09	8.5	9.6	1.10
C	½-5	1.2	22	37	41	8.4	1.31	8.4	9.8	2.95
Cr1	5-9									
Cr2	9+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.5	5.0	10.1	3.7	6.4	21.8	9.5	12.3
C	.2	3.5	15.1	6.1	9.0	27.1	8.9	18.2
Cr1								
Cr2								

LAB ANALYSES FOR Willwood Exclosure

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	48.6	0	.5	0	0	0	.1	9.0	1.9	5.3
C	26.6	0	1.2	.1	0	0	0	10.9	1.9	8.2

LAB ANALYSIS FOR Worland Cattle Company Exclosure (ridgetop position)

ROOTING DEPTH 9"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	3.1	65	13	22	14.2	1.30	6.7	7.7	
C1	3-9	2.8	63	26	11	4.8	1.12	7.7	7.9	.20
Cr	9+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	.8	1.5	16.1	5.9	10.2	17.6	7.2	10.4
C1	.3	.5	8.7	4.1	4.6	9.5	4.6	4.8
Cr								

LAB ANALYSES FOR Worland Cattle Company Exclosure (Ridgetop)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	10.5	0	0	.1	0	0	.3	3.5	2.3	.2
C1	10.4	0	0	.1	0	0	.1	4.5	2.3	.2

LAB ANALYSIS FOR Worland Cattle Company Exclosure (swale position)

ROOTING DEPTH 43"

Horizon	Depth (Inches)	Coarse (%)	Sand (%)	Silt (%)	Clay (%)	Very Fine Sand (%)	Bulk Density (g/cc)	pH		EC (mmhos)
								paste	1:15	
A1	0-3	.8	65	30	5	29.8	1.17	7.6	7.8	.80
A2	3-5	.6	66	29	5	26.4	1.16	7.6	8.2	.30
B2t	5-14	.2	53	19	28	18.8	1.31	8.8	10.3	.85
B3tca	14-24	.1	49	27	24	29.0	1.31	9.2	10.3	2.40
C1ca	24-34	.1	53	45	2	23.4	1.33	8.7	8.8	10.00
C2ca	34-43	.1	53	30	17	34.6	1.39	8.2	8.9	9.50
C3cr	43+									

Horizon	Organic Matter (%)	$CaCo_3$ (%)	% Soil Moisture					
			Profile			Fines		
			1/3 bar	15 bar	Available	1/3 bar	15 bar	Available
A1	5.3	0	21.9	4.4	17.5	12.1	5.0	7.1
A2	.3	1.0	4.1	1.8	2.3	9.2	3.4	5.8
B2t	.5	2.5	22.5	6.1	16.4	33.0	8.6	24.4
B3tca	.5	8.0	24.5	8.4	16.1	35.6	8.9	26.7
C1ca	.4	2.5	12.6	4.1	8.5	21.5	6.9	14.6
C2ca	.2	5.0	15.8	4.8	11.0	8.5	6.0	2.5
C3cr								

LAB ANALYSES FOR Worland Cattle Company Exclosure (Swale)

Horizon	CEC (meq/100 g)	Gypsum (meq/100 g)	Soluble Cations (meq/100g)				Exchangeable Cations (meq/100g)			
			Na	Ca	Mg	K	Na	Ca	Mg	K
A1	7.9	0	0	.2	.1	.1	.6	3.9	2.3	.3
A2	6.1	0	0	.1	0	0	.5	3.0	1.9	.2
B2t	21.6	0	.2	0	0	0	.2	6.0	5.8	6.0
B3tca	13.8	0	.8	0	0	0	0	4.0	4.6	7.0
C1ca	11.8	0	4.7	1.9	2.0	0	0	6.6	4.0	10.0
C2ca	11.8	0	2.9	.4	.6	0	0	4.1	4.4	8.2

APPENDIX C

PERCENT VEGETATIVE COVER

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PERCENT VEGETATIVE COVER
FOR
Basin Flats Exclosure
ARTR Type

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	11.90						9.72	9.26	10.29
PERENNIAL GRASS	.20						.01	.04	.08
ANNUAL GRASS	0						0	0	0
PERENNIAL FORBS	.05						.03	.04	.04
ANNUAL FORBS	.02						0	.23	.08
TOTAL	12.17						9.76	9.57	10.49

PERCENT VEGETATIVE COVER
FOR
Basin Flat Exclosure
ATGA Type

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	6.30						5.64	8.36	6.77
PERENNIAL GRASS	.03						.06	.13	.01
ANNUAL GRASS	0						0	0	0
PERENNIAL FORBS	0						0	.01	T
ANNUAL FORBS	.02						0	.12	.15
TOTAL	6.35						5.70	8.62	6.83

T--Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
BIG BEND EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS					15.75	17.35		19.66	
PERENNIAL GRASS					2.77	2.21		2.83	
ANNUAL GRASS					1.85	.95		.33	
PERENNIAL FORBS					.02	.02		0.00	
ANNUAL FORBS					.22	.44		.11	
TOTAL					20.61	20.97		22.93	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	12.70							22.85	17.66
PERENNIAL GRASS	3.34							2.88	2.81
ANNUAL GRASS	.88							.41	.88
PERENNIAL FORBS	.01							.01	.01
ANNUAL FORBS	.20							.08	.21
TOTAL	17.13							26.23	21.57

PERCENT VEGETATIVE COVER
FOR
BIG FLAT EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS				6.8	6.32	4.95		3.40	
PERENNIAL GRASS				1.57	4.48	2.16		5.74	
ANNUAL GRASS				0.00	0.00	0.00		0.00	
PERENNIAL FORBS				0.00	0.00	0.00		0.00	
ANNUAL FORBS				.07	.66	.25		.035	
TOTAL				8.44	11.46	7.36		9.17	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	9.70						7.08	9.85	6.87
PERENNIAL GRASS	.15						.48	1.06	2.23
ANNUAL GRASS	0.00						0.00	0.00	0.00
PERENNIAL FORBS	0.00						0.00	0.00	0.00
ANNUAL FORBS	.20						.02	.84	.30
TOTAL	10.05						7.58	11.75	9.40

PERCENT VEGETATIVE COVER
FOR
BIG SAGE EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS							9.00	8.58	
PERENNIAL GRASS							11.14	10.99	
ANNUAL GRASS							0.00	0.00	
PERENNIAL FORBS							0.00	0.00	
ANNUAL FORBS							0.00	0.00	
TOTAL							20.14	19.57	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	9.50						10.38	12.48	9.99
PERENNIAL GRASS	13.76						8.90	7.36	10.43
ANNUAL GRASS	0.00						0.00	0.00	0.00
PERENNIAL FORBS	.03						0.00	.03	.01
ANNUAL FORBS	.04						0.00	.08	.02
TOTAL	23.33						19.28	19.95	20.45

PERCENT VEGETATIVE COVER
FOR
BIG SKY EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS							17.98	14.85	
PERENNIAL GRASS							4.12	4.83	
ANNUAL GRASS							0.00	0.00	
PERENNIAL FORBS							.14	.26	
ANNUAL FORBS							0.00	0.00	
TOTAL							22.24	19.94	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	15.82						11.80	8.94	13.88
PERENNIAL GRASS	5.72						3.36	5.86	4.78
ANNUAL GRASS	0.00						0.00	0.00	0.00
PERENNIAL FORBS	.31						.11	.23	.21
ANNUAL FORBS	.01						0.00	0.00	T
TOTAL	21.86						15.27	15.03	18.87

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
BOYSEN EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	0.00	3.20	4.35	.20	1.90	0.00	1.30	0.00	0.00
PERENNIAL GRASS	4.50	16.85	10.45	4.33	6.18	6.08	5.70	8.80	9.92
ANNUAL GRASS	.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	0.00	.33	.06	.25	.20	T	T	.20	7.50
ANNUAL FORBS	.09	.02	.05	.18	0.00	T	T	T	2.50
TOTAL	4.63	20.40	14.91	4.96	8.28	6.08	7.00	9.00	19.92

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	.40	.10	.90	.75	T	.55	.26	.26	.83
PERENNIAL GRASS	13.22	3.88	9.35	6.45	3.43	14.80	8.14	7.63	8.22
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
PERENNIAL FORBS	.11	.10	1.35	.09	1.44	1.36	.74	.25	.82
ANNUAL FORBS	.02	T	0.00	.13	.01	0.00	0.00	.01	.18
TOTAL	13.75	4.08	11.60	7.42	4.88	16.71	9.14	8.15	10.05

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
Bud Kimball Exclosure

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	10.60	4.25	12.97	13.90	21.10	8.36
PERENNIAL GRASS	4.27	4.90	6.53	4.33	3.91	.82	2.1	1.50	2.85
ANNUAL GRASS	0	.08	0	0	0	.01	0	0	0
PERENNIAL FORBS	0	0	0	.05	0	.06	T	T	.14
ANNUAL FORBS	.04	0	.86	.56	0	.47	0.1	T	.08
TOTAL	4.31	4.98	7.39	15.54	8.16	14.33	16.10	22.60	11.43

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	11.16	7.86	14.72	10.55	14.22	15.70	7.79	13.88	9.83
PERENNIAL GRASS	1.24	.87	.54	.66	1.60	2.67	2.96	2.58	2.61
ANNUAL GRASS	0	T	0	0	0	.01	.01	.05	.01
PERENNIAL FORBS	.08	0	.13	.22	0	.19	.26	.12	.07
ANNUAL FORBS	.20	.14	.07	0	1.75	.02	.01	.22	.26
TOTAL	12.68	8.87	15.46	11.43	17.57	18.59	11.03	16.85	12.78

*--No Data Available
T--Trace (<.01

PERCENT VEGETATIVE COVER
FOR
BUFFALO BASIN EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS					10.14	13.68		10.15	
PERENNIAL GRASS					6.38	7.19		5.72	
ANNUAL GRASS					0.00	0.00		0.00	
PERENNIAL FORBS					1.70	1.17		1.30	
ANNUAL FORBS					0.00	.05		.06	
TOTAL					18.24	22.09		17.23	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	13.28							20.72	13.60
PERENNIAL GRASS	5.68							6.17	6.23
ANNUAL GRASS	0.00							0.00	0.00
PERENNIAL FORBS	.92							.90	1.20
ANNUAL FORBS	.04							.02	T
TOTAL	19.92							27.81	21.03

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
BUFFALO CREEK EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	0.00	4.47	5.46	5.93	9.65	6.21	3.60	0.00	0.00
PERENNIAL GRASS	2.91	7.57	7.40	4.96	7.73	6.60	4.50	6.80	7.88
ANNUAL GRASS	.02	.30	.28	.03	.13	.01	0.00	0.00	T
PERENNIAL FORBS	0.00	.05	.11	.16	.06	.08	0.00	T	.01
ANNUAL FORBS	.04	.04	1.36	.41	.28	.36	.20	T	.01
TOTAL	2.97	12.43	14.61	11.49	17.85	13.26	8.30	6.80	7.90

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	5.82	3.02	9.40	5.95	11.95	14.96	10.18	11.26	6.34
PERENNIAL GRASS	10.10	4.93	2.78	2.64	2.37	7.24	3.86	4.18	5.56
ANNUAL GRASS	.03	.07	T	.19	.21	.11	.09	.01	.09
PERENNIAL FORBS	.06	.04	.47	.05	1.14	.04	.64	.29	.19
ANNUAL FORBS	.09	.18	.02	.04	.21	.01	.10	.10	.20
TOTAL	16.10	8.24	12.67	8.87	15.88	22.36	14.87	15.84	12.38

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
BURNT WAGON EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	12.43	11.09	10.21	3.46	6.65	4.62	6.20	2.80	9.67
PERENNIAL GRASS	0.00	.08	.18	.10	.06	.03	0.20	T	.05
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	2.93	.49	.06	.17	.04	.05	T	T	.25
ANNUAL FORBS	.30	.10	.51	0.00	0.00	.10	0.10	0.00	.01
TOTAL	15.66	11.76	10.96	3.73	6.75	4.80	6.50	2.80	9.98

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	6.86	7.81	0.00	0.00	0.00	9.16	4.93	11.30	6.30
PERENNIAL GRASS	.01	.01	T	.02	T	.06	.05	.01	.05
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	.08	.19	.09	.12	1.66	.18	.01	.09	.38
ANNUAL FORBS	.02	T	0.00	T	.69	0.00	0.00	.08	.12
TOTAL	6.97	8.01	.09	.14	2.35	9.40	4.99	11.48	6.84

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
CHALK EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	8.55						10.70	12.82	10.69
PERENNIAL GRASS	0.00						.28	.36	.21
ANNUAL GRASS	0.00						0.00	0.00	0.00
PERENNIAL FORBS	.03						.01	.06	.03
ANNUAL FORBS	0.00						0.00	.01	T
TOTAL	8.58						10.99	13.25	21.83

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
COCHRAN EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	19.00	6.57	16.03	22.13	15.05	13.30	17.40	0.00	0.00
PERENNIAL GRASS	3.08	4.74	3.38	3.98	2.30	2.33	2.70	3.50	2.73
ANNUAL GRASS	0.00	.25	.28	.08	.15	.12	.50	T	.03
PERENNIAL FORBS	0.00	0.00	T	2.73	.02	.08	T	.10	.01
ANNUAL FORBS	0.00	.05	.43	.58	.19	.28	.10	T	.05
TOTAL	22.08	11.61	20.12	29.50	17.71	16.11	20.70	3.60	2.82

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	13.74	8.61	9.40	10.30	4.65	17.30	8.32	14.88	11.57
PERENNIAL GRASS	2.04	.69	3.40	.79	1.94	2.82	1.01	2.47	2.56
ANNUAL GRASS	.06	.13	.12	.17	.79	1.53	.24	.42	.29
PERENNIAL FORBS	.02	0.00	0.00	0.00	.02	0.00	0.00	0.00	.18
ANNUAL FORBS	.10	.13	.08	0.00	.17	0.00	.01	.16	.14
TOTAL	15.96	9.56	12.64	11.26	7.57	21.65	9.58	17.93	14.74

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
DEMER EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	18.10	9.90	18.60	14.65	16.48	8.80	14.80	0.00	0.00
PERENNIAL GRASS	1.66	6.95	7.70	4.43	2.26	2.50	2.60	3.80	3.06
ANNUAL GRASS	.16	.15	.60	.03	.63	.27	.90	0.00	.06
PERENNIAL FORBS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL FORBS	.09	.45	1.60	.36	.20	.13	.10	T	.05
TOTAL	20.01	17.45	28.50	19.47	19.57	11.70	18.40	3.80	3.17

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	16.60	18.45	1.30	8.05	.15	7.43	21.14	9.66	10.83
PERENNIAL GRASS	1.67	1.54	5.29	.57	.88	4.64	1.78	3.90	3.25
ANNUAL GRASS	.01	.10	.47	.15	.65	3.56	.02	.06	.46
PERENNIAL FORBS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL FORBS	.04	.14	.15	.05	.10	.02	0.00	.18	.22
TOTAL	18.32	20.23	7.21	8.82	1.78	15.65	22.94	13.80	14.76

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
DUTCH NICK FLATS EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	7.39	3.29	1.88	1.66	2.76	2.59	3.3	.30	0.00
PERENNIAL GRASS	34.77	14.60	18.98	8.89	21.86	9.09	16.1	16.10	19.00
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	T	T	0.00
PERENNIAL FORBS	.10	.01	0.00	0.00	0.00	.02	T	T	0.00
ANNUAL FORBS	15.07	.14	.66	.03	.56	1.80	.10	.10	0.00
TOTAL	57.33	18.04	21.52	10.58	25.18	13.50	19.50	16.50	19.00

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	.18	.60	1.77	4.90	7.30	2.35	4.58	3.85	2.86
PERENNIAL GRASS	2.59	5.66	12.50	4.95	5.77	28.25	17.16	10.54	14.52
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
PERENNIAL FORBS	.06	0.00	0.00	0.00	0.00	0.00	0.00	.06	.01
ANNUAL FORBS	.21	.08	.06	.01	.43	.02	0.00	.18	1.14
TOTAL	3.04	6.34	14.33	9.86	13.50	30.62	21.74	14.63	18.53

T -- Trace (<.01).

PERCENT VEGETATIVE COVER
FOR
EAST RIDGE EXCLOSURE
ARTR TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS				23.65	17.50	23.65		26.67	
PERENNIAL GRASS				2.55	3.40	1.83		2.00	
ANNUAL GRASS				0.00	0.00	0.00		0.00	
PERENNIAL FORBS				.51	.55	.42		.20	
ANNUAL FORBS				.91	.40	.01		.31	
TOTAL				27.62	21.85	25.91		29.81	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	21.78						28.80	30.76	24.69
PERENNIAL GRASS	2.04						1.18	.96	1.99
ANNUAL GRASS	0.00						0.00	0.00	0.00
PERENNIAL FORBS	.46						.09	.36	.37
ANNUAL FORBS	.04						0.00	.02	.24
TOTAL	24.32						30.07	32.10	27.29

PERCENT VEGETATIVE COVER
FOR
EAST RIDGE EXCLOSURE
AGTA TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS				8.05	7.10	6.85		12.22	
PERENNIAL GRASS				1.72	3.68	1.89		5.79	
ANNUAL GRASS				0.00	0.00	0.00		0.00	
PERENNIAL FORBS				.95	0.00	0.00		T	
ANNUAL FORBS				0.00	.12	.08		0.00	
TOTAL				10.72	10.90	8.82		18.01	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	17.20						11.85	18.35	11.66
PERENNIAL GRASS	.23						3.14	3.60	2.86
ANNUAL GRASS	0.00						0.00	0.00	0.00
PERENNIAL FORBS	.16						.02	.18	.19
ANNUAL FORBS	.21						0.00	.07	.07
TOTAL	17.80						15.01	22.20	14.78

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
GRASS CREEK DIVIDE EXCLOSURE
TYPE A

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS					3.30	3.25		2.44	
PERENNIAL GRASS					8.75	9.26		7.17	
ANNUAL GRASS					0.00	0.00		0.00	
PERENNIAL FORBS					3.18	5.07		5.59	
ANNUAL FORBS					0.00	.05		.03	
TOTAL					15.23	17.63		15.23	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	5.58							11.20	5.15
PERENNIAL GRASS	5.66							7.70	7.71
ANNUAL GRASS	0.00							0.00	0.00
PERENNIAL FORBS	4.78							3.46	4.42
ANNUAL FORBS	.02							.02	.02
TOTAL	17.04							22.38	17.40

PERCENT VEGETATIVE COVER
FOR
GRASS CREEK DIVIDE EXCLOSURE
TYPE B

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS					4.83	6.24		8.20	
PERENNIAL GRASS					4.85	6.35		9.23	
ANNUAL GRASS					0.00	0.00		0.00	
PERENNIAL FORBS					.21	.16		.26	
ANNUAL FORBS					0.00	.02		0.00	
TOTAL					9.89	12.77		17.69	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	8.69							9.08	7.41
PERENNIAL GRASS	6.73							7.71	6.00
ANNUAL GRASS	0.00							0.00	0.00
PERENNIAL FORBS	.27							.50	.28
ANNUAL FORBS	0.00							0.00	T
TOTAL	15.69							17.29	13.69

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
GRASS CREEK DIVIDE EXCLOSURE
TYPE C

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS					12.50	15.07		27.08	
PERENNIAL GRASS					5.05	5.74		6.82	
ANNUAL GRASS					0.00	0.00		0.00	
PERENNIAL FORBS					4.62	5.11		5.74	
ANNUAL FORBS					0.00	.06		0.00	
TOTAL					22.17	25.98		39.64	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	15.23							11.44	16.26
PERENNIAL GRASS	7.54							9.77	6.98
ANNUAL GRASS	0.00							0.00	0.00
PERENNIAL FORBS	5.97							2.64	4.82
ANNUAL FORBS	.01							0.00	.01
TOTAL	28.75							23.85	28.07

PERCENT VEGETATIVE COVER
FOR
GRASS CREEK DIVIDE EXCLOSURE
TYPE D

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS					5.01	5.54		9.10	
PERENNIAL GRASS					5.70	6.17		6.50	
ANNUAL GRASS					0.00	0.00		0.00	
PERENNIAL FORBS					4.82	2.06		2.18	
ANNUAL FORBS					0.00	.16		0.00	
TOTAL					15.53	13.93		17.78	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	6.04							10.01	7.14
PERENNIAL GRASS	6.43							5.67	6.09
ANNUAL GRASS	0.00							0.00	0.00
PERENNIAL FORBS	2.26							2.54	2.77
ANNUAL FORBS	.02							0.00	.04
TOTAL	14.75							18.22	16.04

PERCENT VEGETATIVE COVER
FOR
HALOGETON EXCLOSURE #1[1]

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS		9.60	11.65	3.31	15.33	10.12	12.40	18.50	20.73
PERENNIAL GRASS		.05	.52	.72	.85	.53	.40	T	T
ANNUAL GRASS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS		1.70	.27	.03	.01	.01	T	0.00	T
ANNUAL FORBS		.28	.64	.15	0.00	.11	T	T	T
TOTAL		11.63	13.08	4.21	16.19	10.77	12.80	18.50	20.73

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	18.64	19.62	11.30	7.27	12.14	11.23	8.68	16.22	12.16
PERENNIAL GRASS	.01	.21	.05	.07	.20	1.36	.41	1.54	.48
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	.10	.02	T	0.00	.20	.03	T	.06	.14
ANNUAL FORBS	.01	.03	.01	.01	.11	.14	.02	.11	.10
TOTAL	18.76	19.88	11.36	7.35	12.65	12.76	9.11	17.93	12.88

T -- Trace (<.01)
1--Sampling performed at the East study site.

PERCENT VEGETATIVE COVER
FOR
HALOGETON EXCLOSURE #2

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS		16.96	14.10	5.50	15.69	13.34	10.80	13.00	9.64
PERENNIAL GRASS		.01	.18	.38	2.04	1.37	1.30	2.40	2.56
ANNUAL GRASS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS		.23	.11	.17	0.00	.01	T	0.00	T
ANNUAL FORBS		.13	1.07	.86	.30	.09	T	T	0.00
TOTAL		17.33	15.46	6.91	18.03	14.81	12.10	15.40	12.20

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	14.03	4.24	7.53	4.93	6.12	5.21	4.13	1.41	8.63
PERENNIAL GRASS	2.69	1.10	.70	.23	2.93	4.29	1.88	1.85	1.52
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	0.00	.01	T	0.00	.28	.04	.05	.20	.06
ANNUAL FORBS	.07	.14	T	T	.27	.02	.02	.15	.18
TOTAL	16.79	5.49	8.23	5.16	9.60	9.56	6.08	3.61	10.39

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
HALOGETON EXCLOSURE #3[1]

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS		12.01	15.45	4.25	17.12	11.37	10.70	9.60	23.78
PERENNIAL GRASS		0.00	.03	.02	.24	.11	.10	.70	.91
ANNUAL GRASS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS		.31	.08	.12	0.00	T	T	T	.02
ANNUAL FORBS		.07	.68	.25	.19	.07	T	T	.02
TOTAL		12.39	16.24	4.64	17.55	11.55	10.80	10.30	24.73

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	18.28	.13	10.81	5.07	9.08	7.75	4.28	1.87	10.90
PERENNIAL GRASS	.60	.58	.65	.13	.93	1.22	.53	2.77	.60
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	.01	.02	.01	T	.20	.08	.05	.10	.06
ANNUAL FORBS	.09	.35	.01	.23	.26	.08	.05	.17	.16
TOTAL	18.98	1.08	11.48	5.43	10.47	9.13	4.91	4.91	11.72

T -- Trace (<.01)

1-Sampling performed at the Ridge study site.

PERCENT VEGETATIVE COVER
FOR
HAWK EXCLOSURE
ATGA TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	7.22						7.75	7.80	7.59
PERENNIAL GRASS	.01						0.00	.01	.01
ANNUAL GRASS	0.00						0.00	0.00	0.00
PERENNIAL FORBS	.04						0.00	.36	.13
ANNUAL FORBS	.06						0.00	.06	.04
TOTAL	7.33						7.75	8.23	7.77

PERCENT VEGETATIVE COVER
FOR
HAWK EXCLOSURE
GRSP TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	18.40						21.68	27.74	22.61
PERENNIAL GRASS	1.65						.90	1.46	1.34
ANNUAL GRASS	0.00						0.00	0.00	0.00
PERENNIAL FORBS	0.00						0.00	.01	T
ANNUAL FORBS	.08						.01	.30	.13
TOTAL	20.13						22.59	29.51	24.08

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
HORSECREEK EXCLOSURE
AGSM TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	2.11	10.55	10.85	9.00	6.38	4.45	8.20	2.80	2.23
PERENNIAL GRASS	4.72	10.05	4.88	4.15	2.15	2.10	3.00	2.40	3.45
ANNUAL GRASS	0.00	.02	.03	0.00	0.00	.04	T	0.00	.05
PERENNIAL FORBS	0.00	0.00	0.00	0.00	0.00	0.00	T	0.00	0.00
ANNUAL FORBS	.02	0.00	.18	0.00	0.00	.17	T	0.00	.11
TOTAL	6.85	20.62	15.94	13.15	8.53	6.76	11.20	5.20	5.84

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	7.80	3.45	1.35	1.50	4.50	1.15	13.05	6.65	5.65
PERENNIAL GRASS	1.28	2.13	2.14	1.38	2.47	2.98	1.40	1.32	3.06
ANNUAL GRASS	.49	.03	.85	.06	.06	.18	.47	1.08	.20
PERENNIAL FORBS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
ANNUAL FORBS	T	.13	0.00	0.00	.21	.10	0.00	.20	.07
TOTAL	9.57	5.74	4.34	2.94	7.24	4.41	14.92	9.25	8.98

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
HORSECREEK EXCLOSURE
AGSP TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	11.41	17.24	11.90	12.85	12.73	5.26	4.30	5.60	14.60
PERENNIAL GRASS	2.98	2.26	41.85	5.00	1.96	7.39	3.10	2.50	7.80
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	0.00	.08	0.00	.10	0.00	0.00	T	T	.01
ANNUAL FORBS	0.00	0.00	0.00	0.00	0.00	.05	0.00	0.00	T
TOTAL	14.39	19.58	53.75	17.95	14.69	12.70	7.40	8.10	22.41

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	3.38	2.78	1.48	2.72	.78	10.45	1.36	2.70	7.15
PERENNIAL GRASS	5.45	4.33	2.20	2.38	2.61	2.71	3.24	2.62	5.90
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	T
PERENNIAL FORBS	0.00	T	.20	0.00	.25	0.00	.01	0.00	.04
ANNUAL FORBS	T	.06	0.00	0.00	.16	0.00	0.00	.22	.03
TOTAL	8.83	7.17	3.88	5.10	3.80	13.16	4.61	5.55	13.12

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
Horse Creek Exclosure
ARNO Type

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS								17.22	17.22
PERENNIAL GRASS								1.04	1.04
ANNUAL GRASS								0	0
PERENNIAL FORBS								.01	.01
ANNUAL FORBS								.09	.09
TOTAL								18.36	18.36

PERCENT VEGETATIVE COVER
FOR
KIRBY CREEK EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	4.00	6.60	3.00	2.50	5.75	6.53	4.60	.04	6.05
PERENNIAL GRASS	.25	1.01	2.20	1.28	1.63	1.98	.40	.90	1.69
ANNUAL GRASS	.10	.15	.87	.83	.33	.95	1.20	T	.02
PERENNIAL FORBS	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL FORBS	.19	6.53	9.17	2.39	0.00	1.18	T	.30	.85
TOTAL	4.54	14.29	15.25	7.00	7.81	10.64	6.20	1.24	8.61

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	5.65	5.15	4.40	11.80	6.50	7.98	3.40	5.36	5.25
PERENNIAL GRASS	1.28	.52	2.03	.65	1.02	2.66	.62	2.04	1.30
ANNUAL GRASS	0.00	.04	.08	0.00	.12	1.25	.40	.18	.38
PERENNIAL FORBS	0.00	T	0.00	0.00	0.00	0.00	0.00	.03	T
ANNUAL FORBS	.73	.36	1.51	0.00	2.14	.72	.62	.70	1.61
TOTAL	7.66	6.07	8.02	12.45	9.78	12.61	5.04	8.31	8.54

T -- Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
Lower Enos Creek Exclosure

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS						18.68		.13	
PERENNIAL GRASS						7.13		6.54	
ANNUAL GRASS						0		0	
PERENNIAL FORBS						1.20		.62	
ANNUAL FORBS						0		T	
TOTAL						27.01		7.29	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	2.40							1.01	5.56
PERENNIAL GRASS	8.60							7.92	7.55
ANNUAL GRASS	0							0	0
PERENNIAL FORBS	.28							.34	.61
ANNUAL FORBS	.03							0	.01
TOTAL	11.31							9.27	13.73

PERCENT VEGETATIVE COVER
FOR
NORTH BUTTE RELICT AREA

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	11.01	1.55	9.26	1.93	7.30	3.20	6.50	2.90	7.85
PERENNIAL GRASS	3.90	7.24	10.78	5.51	2.83	3.72	3.20	7.70	6.62
ANNUAL GRASS	0	0	0	0	0	0	0	0	0
PERENNIAL FORBS	.02	.05	.17	.21	.13	.08	.01	T	.04
ANNUAL FORBS	.01	0	.17	.19	.03	.10	T	0	T
TOTAL	14.94	8.84	20.38	7.84	10.29	7.10	9.71	10.60	14.51

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	2.49	2.81	5.37	4.22	.90	9.25	1.90	1.50	4.70
PERENNIAL GRASS	8.67	6.09	5.20	2.71	3.07	7.36	11.21	8.12	6.11
ANNUAL GRASS	0	0	0	0	.01	0	0	0	T
PERENNIAL FORBS	.04	.01	.02	.21	.87	.34	.06	.08	.14
ANNUAL FORBS	.06	.08	T	.01	.19	0	.02	.01	.05
TOTAL	11.26	8.99	10.59	7.15	5.04	16.95	13.19	9.71	11.00

T--Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
POTATO RIDGE EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	12.20						10.42	15.86	12.83
PERENNIAL GRASS	.05						.25	.53	.28
ANNUAL GRASS	0						0	0	0
PERENNIAL FORBS	0						0	0	0
ANNUAL FORBS	0						0	.05	.02
TOTAL	12.25						10.67	16.44	13.13

PERCENT VEGETATIVE COVER
FOR
RANKIN BASIN EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS				17.45	16.46	18.04		18.01	
PERENNIAL GRASS				6.77	6.85	5.03		7.71	
ANNUAL GRASS				0	0	0		0	
PERENNIAL FORBS				.07	.02	.11		.01	
ANNUAL FORBS				.93	.22	.02		.01	
TOTAL				25.22	23.55	23.20		25.74	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	14.10						12.91	11.47	15.49
PERENNIAL GRASS	5.68						3.55	2.64	5.46
ANNUAL GRASS	0						0	0	0
PERENNIAL FORBS	.09						.01	.02	.05
ANNUAL FORBS	.04						0	0	.17
TOTAL	19.91						16.47	14.13	21.17

PERCENT VEGETATIVE COVER
FOR
ROUND TOP MOUNTAIN RELICT AREA

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS		4.55	.35	.55	0	2.41	8.70	.10	1.35
PERENNIAL GRASS		12.15	18.81	9.08	6.10	6.23	4.10	6.30	12.20
ANNUAL GRASS		0	0	0	.03	0	T	0	0
PERENNIAL FORBS		.25	0	.15	.14	.13	T	0	.07
ANNUAL FORBS		0	T	.03	.26	.14	T	T	.21
TOTAL		16.95	19.16	9.81	6.53	8.91	12.80	6.40	13.83

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	2.32	4.50	0	15.25	3.40	2.50	1.85	3.99	3.05
PERENNIAL GRASS	7.68	7.31	8.41	1.74	3.09	10.65	5.33	8.36	7.50
ANNUAL GRASS	0	0	0	T	0	.13	.01	.08	.01
PERENNIAL FORBS	.07	.28	.01	0	.27	1.07	1.60	.19	.25
ANNUAL FORBS	.06	.12	0	.01	.31	.02	.01	.14	.08
TOTAL	10.13	12.21	8.42	17.00	7.07	14.37	8.80	12.76	10.89

T--Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
SAND CREEK EXCLOSURE
ARSP TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	8.00						7.72	14.50	10.07
PERENNIAL GRASS	.10						.49	.40	.33
ANNUAL GRASS	0						0	0	0
PERENNIAL FORBS	0						0	0	0
ANNUAL FORBS	.50						.04	.12	.21
TOTAL	8.60						8.25	15.02	10.61

PERCENT VEGETATIVE COVER
FOR
SAND CREEK EXCLOSURE
ARTR TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	4.75						3.38	2.75	3.63
PERENNIAL GRASS	.60						3.62	4.66	2.96
ANNUAL GRASS	0						0	0	0
PERENNIAL FORBS	0						0	0	0
ANNUAL FORBS	.25						.01	.12	.13
TOTAL	5.60						7.01	7.53	6.72

PERCENT VEGETATIVE COVER
FOR
SAND GULCH EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	9.53	2.06	13.51	12.07	9.55	7.92	6.50	10.00	8.42
PERENNIAL GRASS	.75	2.07	1.83	2.86	2.37	.88	1.20	1.30	1.89
ANNUAL GRASS	.04	.07	.14	.45	1.16	1.10	1.70	0	T
PERENNIAL FORBS	0	0	T	.01	0	0	0	0	T
ANNUAL FORBS	0	0	.06	.07	.02	.05	T	.20	.15
TOTAL	10.32	4.20	15.54	15.46	13.10	9.95	9.40	11.50	10.46

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	4.06	3.37	5.92	4.91	9.37	7.33	7.67	11.30	7.85
PERENNIAL GRASS	3.31	1.68	.97	.85	8.90	1.81	1.47	1.79	2.11
ANNUAL GRASS	.03	.17	2.56	.17	.79	2.08	.43	.15	.65
PERENNIAL FORBS	.01	.01	T	T	.14	0	T	.01	.01
ANNUAL FORBS	.06	.14	1.17	T	.35	.17	.01	.13	.15
TOTAL	7.47	5.37	10.62	5.93	19.55	11.39	9.58	13.38	10.77

T--Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
SHELDON GULCH EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	13.85						15.90	18.90	16.22
PERENNIAL GRASS	0						0	.01	T
ANNUAL GRASS	0						0	0	0
PERENNIAL FORBS	0						0	0	0
ANNUAL FORBS	.08						.01	.06	.03
TOTAL	13.93						15.91	18.97	16.25

T--Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
SMILO EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	5.61	14.75	5.60	6.30	16.63	13.30	8.30	0	0
PERENNIAL GRASS	2.77	3.53	4.18	2.12	1.40	.77	.90	2.40	1.42
ANNUAL GRASS	.40	.13	.28	.03	.38	.05	T	0	0
PERENNIAL FORBS	0	0	0	0	0	.01	0	0	0
ANNUAL FORBS	.16	.22	.43	.26	.18	.28	.20	T	0
TOTAL	8.94	18.63	10.49	8.71	18.59	14.41	9.40	2.40	1.42

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	16.10	7.82	14.75	6.15	12.80	7.40	12.95	7.25	9.16
PERENNIAL GRASS	.34	.42	2.84	.75	1.67	3.52	2.11	1.84	1.94
ANNUAL GRASS	0	.07	.38	.20	.67	.06	.08	.16	.17
PERENNIAL FORBS	0	T	0	0	0	.02	0	.01	.01
ANNUAL FORBS	.02	.07	.05	.02	.07	.01	.02	.07	.12
TOTAL	16.46	8.38	18.02	7.12	15.21	11.01	15.16	9.33	11.39

T--Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
TOLMAN RIDGE EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	3.90						2.15	3.11	3.05
PERENNIAL GRASS	.02						4.32	3.68	2.67
ANNUAL GRASS	.04						.14	.12	.10
PERENNIAL FORBS	.01						0	0	T
ANNUAL FORBS	.26						.08	.17	.17
TOTAL	4.23						6.69	7.08	5.99

T--Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
TWO MILE HILL EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	6.05	8.88	8.45	4.76	7.81	7.92	4.50	4.80	9.56
PERENNIAL GRASS	.42	.04	.13	.15	2.15	1.38	.90	.50	.16
ANNUAL GRASS	.14	2.06	4.49	.87	.41	.86	.90	.40	.35
PERENNIAL FORBS	0	0	0	.07	0	T	.10	T	.01
ANNUAL FORBS	.60	0	.21	.63	.03	.11	T	T	.18
TOTAL	7.21	10.98	13.28	6.48	10.40	10.27	6.40	5.70	10.26

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	.16	1.81	1.50	1.89	0	4.48	3.62	6.89	4.89
PERENNIAL GRASS	.48	.31	1.92	1.35	.65	3.74	4.03	4.20	1.32
ANNUAL GRASS	.19	.47	.11	.53	.51	1.48	.70	.52	.88
PERENNIAL FORBS	.03	.03	.01	.02	.05	.02	.03	.02	.02
ANNUAL FORBS	.54	.09	.03	.20	.31	.06	.01	.21	.19
TOTAL	1.40	2.71	3.57	3.99	1.52	9.78	8.39	11.84	7.30

T--Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
Upper Enos Creek Exclosure

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS				46.20	3.85	4.35		5.00	
PERENNIAL GRASS				6.70	3.72	9.29		4.51	
ANNUAL GRASS				0	0	0		0	
PERENNIAL FORBS				2.72	1.48	2.77		2.32	
ANNUAL FORBS				0	0	0		.14	
TOTAL				55.62	9.05	16.41		11.97	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	5.14							5.65	11.69
PERENNIAL GRASS	5.94							6.34	6.08
ANNUAL GRASS	0							0	0
PERENNIAL FORBS	3.81							4.42	2.92
ANNUAL FORBS	.24							0	.06
TOTAL	15.13							16.41	19.75

PERCENT VEGETATIVE COVER
FOR
Upper Grass Creek Exclosure

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS				16.82	2.15	2.75		3.36	
PERENNIAL GRASS				9.62	7.90	8.62		5.98	
ANNUAL GRASS				0	0	0		0	
PERENNIAL FORBS				3.68	2.12	2.62		3.56	
ANNUAL FORBS				0	.48	.08		.06	
TOTAL				30.12	12.65	14.07		18.96	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	3.86							25.08	9.00
PERENNIAL GRASS	4.93							4.80	6.98
ANNUAL GRASS	0							0	0
PERENNIAL FORBS	3.56							5.16	3.45
ANNUAL FORBS	.04							0	.17
TOTAL	12.39							35.04	19.60

PERCENT VEGETATIVE COVER
FOR
UPPER LEFTHAND CREEK EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS				14.66	6.96	14.18		14.49	
PERENNIAL GRASS				8.41	7.12	7.91		6.37	
ANNUAL GRASS				0	0	0		0	
PERENNIAL FORBS				11.22	3.90	7.56		6.34	
ANNUAL FORBS				0	0	.05		0	
TOTAL				34.29	17.98	29.70		27.20	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	18.72							17.13	14.36
PERENNIAL GRASS	7.50							7.74	7.51
ANNUAL GRASS	0							0	0
PERENNIAL FORBS	3.76							2.85	5.94
ANNUAL FORBS	.10							0	.02
TOTAL	30.08							27.72	27.83

PERCENT VEGETATIVE COVER
FOR
WEST PASTURE EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	17.87	10.30	8.84	5.32	5.61	8.11	6.10	4.60	3.52
PERENNIAL GRASS	11.89	.59	1.19	.97	1.44	.94	1.40	2.50	3.52
ANNUAL GRASS	0	0	0	0	0	0	0	0	0
PERENNIAL FORBS	4.82	0	.09	.05	.14	.15	T	T	.11
ANNUAL FORBS	20.24	1.00	1.70	.61	2.35	.17	.70	.20	.02
TOTAL	54.82	11.89	11.82	6.95	9.54	9.37	8.20	7.30	7.17

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	6.65	5.84	3.05	4.50	8.50	8.59	7.33	10.36	7.36
PERENNIAL GRASS	1.59	1.98	.35	.25	1.10	1.67	.71	.43	1.91
ANNUAL GRASS	0	0	0	0	0	0	0	0	0
PERENNIAL FORBS	.02	.02	.03	.01	.80	.12	.08	.13	.39
ANNUAL FORBS	.04	.27	.01	.07	.35	.27	.02	.05	1.65
TOTAL	8.30	8.11	3.44	4.83	10.75	10.65	8.14	10.98	11.31

T--Trace (<.01)

PERCENT VEGETATIVE COVER
FOR
WILLWOOD EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	7.50						8.00	7.58	7.69
PERENNIAL GRASS	.01						.01	.06	.03
ANNUAL GRASS	0						0	0	0
PERENNIAL FORBS	.12						0	.22	.11
ANNUAL FORBS	.04						0	.09	.06
TOTAL	7.67						8.01	7.95	7.89

PERCENT VEGETATIVE COVER
FOR
WORLAND CATTLE COMPANY EXCLOSURE[1]

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS					5.06	1.77		7.37	
PERENNIAL GRASS					1.86	1.45		4.67	
ANNUAL GRASS					1.52	1.15		2.08	
PERENNIAL FORBS					0	0		T	
ANNUAL FORBS					.54	4.54		.25	
TOTAL					8.98	8.91		14.37	

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	7.40						6.15	7.95	5.95
PERENNIAL GRASS	3.58						2.26	1.20	2.50
ANNUAL GRASS	.41						.32	.73	1.04
PERENNIAL FORBS	.04						.04	.14	.04
ANNUAL FORBS	8.05						.02	.13	2.26
TOTAL	19.48						8.79	10.15	11.79

T--Trace (<.01)
1--Sampling performed at the Ridge Position study site.

APPENDIX D

ANNUAL VEGETATIVE PRODUCTION

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ANNUAL PRODUCTION DATA
FOR
BOYSEN EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	*	*	*	26.80	*	*
PERENNIAL GRASS	210.82	234.85	264.24	155.90	90.40	334.75	232.22	251.76	94.83
ANNUAL GRASS	5.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	0.00	23.38	18.77	21.31	T	45.89	13.77	16.37	21.32
ANNUAL FORBS	23.04	.86	.82	.34	0.00	23.23	.34	.24	2.11
TOTAL	239.72	259.09	283.83	267.95	90.40	403.87	273.13	268.37	118.26

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	49.30	22.75	10.92	5.38	12.57	10.43	9.65	7.50	17.25
PERENNIAL GRASS	230.58	207.82	262.56	162.35	527.32	237.44	156.54	158.65	224.30
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.34
PERENNIAL FORBS	30.97	24.10	38.80	20.26	54.64	41.25	29.34	32.80	25.47
ANNUAL FORBS	36.83	.05	0.00	8.55	.24	0.00	0.00	.05	5.69
TOTAL	347.68	254.72	312.28	196.54	594.77	289.12	195.53	199.00	273.05

* -- No data available.

T -- Trace (<.01)

ANNUAL PRODUCTION DATA
FOR
BUD KIMBALL EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	*	*	*	*	*	*
PERENNIAL GRASS	187.10	162.34	151.67	185.86	101.62	84.48	463.72	212.30	138.33
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	.05	0.00	0.00	0.00
PERENNIAL FORBS	0.00	0.00	0.00	.67	0.00	2.11	0.00	0.00	4.22
ANNUAL FORBS	.96	.82	0.00	15.22	0.00	312.29	45.55	2.97	4.13
TOTAL	188.06	163.16	151.67	201.75	101.62	398.93	509.27	215.27	146.68

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	137.75	105.49	121.55	188.30	176.28	172.65	276.42	172.48	168.87
PERENNIAL GRASS	213.44	148.37	70.82	134.78	365.74	158.55	270.48	204.12	191.40
ANNUAL GRASS	0.00	.14	0.00	0.00	0.00	.05	3.41	2.45	.36
PERENNIAL FORBS	8.02	0.00	7.39	21.70	0.00	8.07	4.18	31.93	5.19
ANNUAL FORBS	8.69	14.41	2.88	0.00	159.37	1.68	1.15	14.31	34.38
TOTAL	367.90	268.41	202.64	344.78	701.39	341.00	555.64	425.29	400.20

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
BUFFALO CREEK EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	*	*	*	236.30	*	*
PERENNIAL GRASS	385.83	341.98	399.25	412.89	368.01	623.66	585.17	521.48	350.38
ANNUAL GRASS	19.68	13.25	11.28	.24	4.13	3.36	1.63	0.00	.48
PERENNIAL FORBS	0.00	.53	9.90	7.92	0.00	22.99	4.17	4.75	1.63
ANNUAL FORBS	71.33	0.00	106.75	6.34	6.38	88.75	19.78	3.17	.38
TOTAL	476.84	355.76	527.18	427.39	378.52	738.76	847.05	529.40	352.87

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	107.90	357.17	169.56	779.64	222.52	159.89	225.79	130.74	265.50
PERENNIAL GRASS	499.25	446.61	208.39	234.08	439.31	286.66	239.56	402.86	397.11
ANNUAL GRASS	2.50	20.07	.05	26.31	27.61	6.19	7.54	.48	8.52
PERENNIAL FORBS	5.09	17.05	3.55	4.08	18.97	1.97	3.51	33.90	8.24
ANNUAL FORBS	1.63	4.95	.53	2.06	12.92	.14	1.92	2.40	19.38
TOTAL	566.37	845.85	382.08	1046.17	721.33	454.85	478.32	570.38	698.75

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
BURNT WAGON EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	414.10	392.42	500.35	154.76	111.96	207.44	195.60	195.60	85.32
PERENNIAL GRASS	0.00	7.78	22.51	8.85	1.47	.57	2.04	2.04	.59
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	15.60	22.67	18.56	3.31	.73	.80	1.26	1.26	2.41
ANNUAL FORBS	30.50	.14	6.95	0.00	0.00	5.74	.11	.11	0.00
TOTAL	460.20	423.01	548.37	166.92	114.16	214.55	199.01	199.01	88.32

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	165.51	263.44	181.38	163.25	680.03	258.16	79.17	366.02	259.68
PERENNIAL GRASS	.23	.36	.67	1.06	.02	3.24	.02	.48	3.05
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	5.19	34.06	11.62	8.44	61.41	32.05	.86	19.95	14.13
ANNUAL FORBS	.96	.48	0.00	.12	10.87	0.00	0.00	10.65	3.92
TOTAL	171.89	298.34	193.67	172.87	752.33	293.45	80.05	397.15	280.78

ANNUAL PRODUCTION DATA
FOR
COCHRAN EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	*	*	*	317.00	*	*
PERENNIAL GRASS	294.05	189.22	168.67	280.80	179.42	258.30	331.87	239.66	89.60
ANNUAL GRASS	0.00	3.31	7.25	.29	4.32	49.06	31.92	1.10	1.63
PERENNIAL FORBS	0.00	0.00	.96	3.70	0.00	9.94	2.54	7.44	.86
ANNUAL FORBS	0.00	0.00	6.82	5.38	1.34	49.15	4.37	4.90	2.16
TOTAL	294.05	192.53	183.70	290.17	185.05	366.45	687.70	253.10	94.25

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	170.02	212.78	411.41	284.72	243.41	292.58	210.10	54.60	244.06
PERENNIAL GRASS	160.04	198.93	146.02	91.18	485.79	126.81	119.75	118.84	204.64
ANNUAL GRASS	3.22	34.48	19.59	17.14	380.10	74.57	21.61	26.46	39.77
PERENNIAL FORBS	4.85	0.00	0.00	0.00	1.68	0.00	0.00	0.00	1.88
ANNUAL FORBS	2.11	5.91	1.82	0.00	5.43	0.00	.05	4.71	5.54
TOTAL	340.24	452.10	578.84	393.04	1116.41	493.96	351.51	204.61	495.89

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
DEMER EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	*	*	*	197.40	*	*
PERENNIAL GRASS	88.80	119.50	154.37	166.04	85.05	129.12	110.84	118.71	38.69
ANNUAL GRASS	106.56	2.35	13.10	.05	6.59	107.67	93.02	0.00	.05
PERENNIAL FORBS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL FORBS	43.20	0.00	27.50	9.89	.38	11.76	5.81	1.01	.05
TOTAL	238.56	121.85	194.97	175.98	92.02	248.55	407.07	119.72	38.79

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	222.53	385.78	174.54	314.68	469.76	119.38	206.77	307.62	266.50
PERENNIAL GRASS	92.24	174.45	123.12	51.52	182.32	93.15	95.75	159.94	116.68
ANNUAL GRASS	.53	11.04	48.64	83.50	189.76	72.27	.43	3.79	43.49
PERENNIAL FORBS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL FORBS	.29	11.86	12.48	.10	3.22	.86	0.00	27.95	9.20
TOTAL	315.58	583.13	358.78	449.80	845.06	285.66	302.95	499.30	435.87

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
DUTCH NICK FLATS EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	28.20	*	*	*	4.11	17.47	78.99	*	*
PERENNIAL GRASS	176.50	260.17	312.84	195.25	93.69	329.64	313.47	308.12	349.80
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	.04	.04	0.00
PERENNIAL FORBS	7.90	.46	0.00	0.00	0.00	8.27	T	0.00	0.00
ANNUAL FORBS	391.00	4.76	22.26	.49	25.22	75.45	48.44	5.72	.29
TOTAL	603.60	265.39	335.10	195.74	123.02	430.83	440.94	314.38	350.09

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	50.83	72.93	89.94	60.38	35.30	82.60	87.46	49.78	54.83
PERENNIAL GRASS	99.30	366.61	258.38	160.04	684.19	672.81	312.83	316.86	306.53
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
PERENNIAL FORBS	6.15	0.00	0.00	0.00	0.00	0.00	0.00	40.14	3.70
ANNUAL FORBS	48.06	5.57	5.04	.14	38.17	1.34	0.00	90.42	42.79
TOTAL	204.34	445.11	353.36	220.56	757.66	756.75	400.29	497.20	407.85

* -- No data available.

T -- Trace (<.01)

ANNUAL PRODUCTION DATA
FOR
HALOGETON EXCLOSURE #1[1]

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	447.40	618.98	432.43	180.93	359.42	414.24	729.95	508.13
PERENNIAL GRASS	*	4.04	21.30	69.50	23.42	32.45	14.57	.17	.48
ANNUAL GRASS	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	*	5.50	6.57	.50	.24	.31	.06	0.00	.01
ANNUAL FORBS	*	37.02	29.68	3.15	0.00	15.80	8.50	.03	.13
TOTAL	*	493.96	676.53	505.58	204.59	407.98	437.37	730.15	508.75

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	400.60	557.95	245.69	242.37	616.60	350.69	195.71	429.13	395.86
PERENNIAL GRASS	.20	18.21	2.16	9.35	26.60	84.02	38.26	328.43	39.60
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	1.34	3.10	.17	0.00	5.53	1.61	.47	25.70	3.01
ANNUAL FORBS	1.84	4.55	T	.56	4.36	21.02	.50	23.27	8.85
TOTAL	403.98	560.02	248.02	252.28	653.09	457.33	234.93	806.54	447.32

T -- Trace (<.01)

* -- No data available.

1--Sampling performed at the East study site.

ANNUAL PRODUCTION DATA
FOR
HALOGETON EXCLOSURE #2

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	611.51	644.31	696.93	298.23	497.51	303.65	486.24	225.84
PERENNIAL GRASS	*	.81	15.70	42.66	89.67	108.36	154.24	245.07	166.01
ANNUAL GRASS	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	*	2.48	4.35	8.47	0.00	1.02	.31	0.00	.12
ANNUAL FORBS	*	3.76	50.14	28.75	5.11	10.54	8.52	.65	0.00
TOTAL	*	618.56	714.50	776.81	393.01	617.43	466.74	731.96	386.97

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	448.91	592.78	242.81	150.65	456.93	256.11	228.23	540.44	393.00
PERENNIAL GRASS	197.31	154.60	56.78	50.31	387.96	332.42	188.08	302.79	146.34
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	0.00	.56	.09	0.00	2.79	2.70	2.97	47.05	4.29
ANNUAL FORBS	7.81	27.86	.01	.50	11.41	.24	.62	39.59	11.50
TOTAL	654.03	775.80	299.69	201.46	859.09	591.46	419.90	929.98	555.13

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
HALOGETON EXCLOSURE #3[1]

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	557.32	634.98	429.30	241.41	460.57	398.82	484.87	390.35
PERENNIAL GRASS	*	0.00	.65	2.54	15.53	24.10	34.84	88.58	50.93
ANNUAL GRASS	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	*	2.88	3.21	5.67	0.00	1.68	.38	5.06	2.45
ANNUAL FORBS	*	1.50	26.28	7.65	4.57	10.69	52.55	1.84	2.91
TOTAL	*	561.70	665.12	445.16	261.51	497.04	486.59	580.35	446.64

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	372.08	439.84	321.19	106.86	409.08	306.30	225.92	516.81	393.48
PERENNIAL GRASS	62.80	305.49	46.70	35.82	202.71	119.20	104.43	516.14	100.65
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	2.18	2.40	.61	.47	4.48	4.54	5.14	23.86	4.06
ANNUAL FORBS	14.06	29.52	.04	29.67	9.92	1.48	1.87	31.64	14.14
TOTAL	451.12	777.25	368.50	172.82	626.19	431.51	512.49	1088.76	512.33

* -- No data available.
1--Sampling performed at the Ridge study site.

ANNUAL PRODUCTION DATA
FOR
HORSE CREEK EXCLOSURE
AGSM TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	23.90	*	*	*	*	*	*	*	*
PERENNIAL GRASS	729.02	495.89	246.38	397.34	369.60	464.64	771.20	661.97	261.99
ANNUAL GRASS	0.00	0.00	.10	0.00	0.00	6.62	.05	0.00	2.30
PERENNIAL FORBS	0.00	0.00	0.00	0.00	0.00	0.00	.05	0.00	0.00
ANNUAL FORBS	0.00	0.00	.48	0.00	0.00	16.90	.05	0.00	11.76
TOTAL	752.92	495.89	246.96	397.34	369.60	488.16	771.35	661.97	276.05

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	98.69	137.57	39.79	90.53	211.95	76.86	10.87	161.70	94.65
PERENNIAL GRASS	191.83	324.45	315.23	248.82	523.05	368.10	228.03	417.12	412.63
ANNUAL GRASS	22.66	4.37	181.98	8.21	8.40	10.76	41.63	202.49	28.80
PERENNIAL FORBS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
ANNUAL FORBS	.05	19.78	0.00	0.00	12.53	3.03	0.00	21.51	5.06
TOTAL	313.23	486.17	537.00	347.56	755.93	458.75	280.53	802.82	541.14

* -- No data available.

T -- Trace (<.01)

ANNUAL PRODUCTION DATA
FOR
HORSE CREEK EXCLOSURE
AGSP TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	*	*	*	*	*	*
PERENNIAL GRASS	468.67	88.22	342.67	487.25	226.94	502.99	689.81	862.90	341.83
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	0.00	1.68	0.00	.72	0.00	0.00	2.74	.19	.53
ANNUAL FORBS	0.00	0.00	0.00	0.00	0.00	9.70	0.00	0.00	.05
TOTAL	468.67	89.90	342.67	487.97	226.94	512.69	692.55	863.09	342.41

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	89.13	105.90	61.18	49.34	71.75	37.66	27.41	183.52	78.24
PERENNIAL GRASS	452.56	371.60	285.51	239.70	467.11	264.72	362.96	544.85	411.78
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.29	.02
PERENNIAL FORBS	0.00	.86	4.75	0.00	1.78	0.00	.58	0.00	.81
ANNUAL FORBS	.05	5.47	0.00	0.00	8.84	0.00	0.00	24.25	2.84
TOTAL	541.74	483.73	351.44	289.04	549.48	302.38	390.95	752.91	493.69

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
HORSE CREEK EXCLOSURE
ARNO TYPE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS									
PERENNIAL GRASS									
ANNUAL GRASS									
PERENNIAL FORBS									
ANNUAL FORBS									
TOTAL									

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS								328.34	328.34
PERENNIAL GRASS								196.87	196.87
ANNUAL GRASS								0.00	0.00
PERENNIAL FORBS								.53	.53
ANNUAL FORBS								10.28	10.28
TOTAL								536.02	536.02

ANNUAL PRODUCTION DATA
FOR
KIRBY CREEK EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	*	*	*	236.10	*	*
PERENNIAL GRASS	63.45	69.31	194.01	134.93	134.45	284.54	42.53	176.31	160.91
ANNUAL GRASS	101.66	26.45	67.25	90.86	30.53	374.49	213.26	.77	4.32
PERENNIAL FORBS	0.00	0.00	1.68	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL FORBS	175.78	839.09	796.85	235.73	0.00	1106.26	77.04	44.87	167.00
TOTAL	340.89	934.85	1059.79	461.52	164.98	1765.39	568.93	221.95	332.23

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	20.40	86.79	134.38	228.77	185.52	107.36	123.59	7.47	125.59
PERENNIAL GRASS	234.18	277.87	215.64	138.91	638.48	208.44	131.85	787.72	229.03
ANNUAL GRASS	0.00	55.46	23.77	0.00	41.73	135.60	63.72	49.46	75.25
PERENNIAL FORBS	0.00	.34	0.00	0.00	0.00	0.00	0.00	19.01	1.24
ANNUAL FORBS	211.27	337.03	315.86	0.00	1208.92	76.35	91.28	329.73	353.71
TOTAL	465.85	757.49	689.65	367.68	2074.65	527.75	410.44	1193.39	784.82

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
NORTH BUTTE RELICT AREA

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	27.84	*	*	*	*	*	91.00	*	*
PERENNIAL GRASS	1088.93	701.61	695.56	472.60	192.96	515.37	444.77	465.36	356.57
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	.30	0.00	.77	2.74	1.10	11.14	14.21	5.18	3.94
ANNUAL FORBS	3.84	0.00	2.64	3.94	.05	21.31	.05	0.00	1.01
TOTAL	1120.91	701.61	698.97	479.28	194.11	547.82	550.03	470.54	361.52

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	68.69	57.79	23.15	70.66	71.50	88.73	34.79	143.59	67.77
PERENNIAL GRASS	806.30	516.13	526.65	595.36	1051.66	308.94	659.32	783.78	602.72
ANNUAL GRASS	0.00	0.00	0.00	0.00	6.19	0.00	0.00	0.00	.36
PERENNIAL FORBS	12.10	.34	3.03	4.27	46.05	12.20	2.30	9.60	7.60
ANNUAL FORBS	9.46	10.76	.53	.62	14.69	0.00	.58	.53	4.12
TOTAL	896.55	585.02	553.36	670.91	1189.89	409.87	696.99	937.50	682.57

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
ROUND TOP MOUNTAIN RELICT AREA

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	*	*	*	10.50	*	*
PERENNIAL GRASS	*	524.82	869.85	591.02	537.21	710.88	623.41	683.04	413.17
ANNUAL GRASS	*	0.00	0.00	0.00	.05	0.00	5.33	0.00	0.00
PERENNIAL FORBS	*	0.00	0.00	7.15	9.46	17.86	.43	0.00	28.14
ANNUAL FORBS	*	0.00	.91	.77	2.93	35.81	.09	3.74	32.32
TOTAL	*	524.82	870.76	598.94	549.65	764.55	639.76	686.78	473.63

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	146.65	52.90	25.60	36.73	149.32	67.42	78.40	112.71	86.69
PERENNIAL GRASS	439.11	740.08	500.19	401.52	996.26	603.14	404.54	509.75	596.75
ANNUAL GRASS	0.00	0.00	0.00	.05	0.00	6.82	.10	3.65	1.00
PERENNIAL FORBS	13.97	7.63	4.27	0.00	8.79	59.69	33.37	41.29	14.50
ANNUAL FORBS	2.11	35.68	0.00	2.30	29.77	.14	.86	6.87	9.64
TOTAL	601.84	836.29	530.06	440.60	1184.14	737.21	517.27	674.27	708.58

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
SAND GULCH EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	357.79	783.58	829.43	398.57	169.87	292.16	199.38	347.68	148.83
PERENNIAL GRASS	89.48	118.81	187.25	243.53	106.14	165.47	183.42	62.75	209.91
ANNUAL GRASS	100.22	2.56	3.27	64.87	74.09	443.18	288.07	85.63	16.27
PERENNIAL FORBS	0.00	T	T	.08	0.00	0.00	0.00	0.00	.20
ANNUAL FORBS	0.00	.25	4.69	.38	.23	15.37	1.13	0.00	.28
TOTAL	547.49	905.20	1024.64	1106.00	350.33	916.18	672.00	496.06	375.49

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	494.77	718.91	137.50	152.30	566.58	264.55	185.95	480.59	384.02
PERENNIAL GRASS	160.53	305.57	110.45	158.19	368.99	182.74	199.77	503.64	197.45
ANNUAL GRASS	2.08	93.72	188.09	26.64	467.19	166.18	53.92	29.52	123.85
PERENNIAL FORBS	.75	.60	.06	.32	6.02	0.00	.01	7.39	.91
ANNUAL FORBS	4.58	47.82	34.99	.05	15.25	5.99	.91	48.29	10.78
TOTAL	662.71	1166.62	471.09	337.50	1424.03	619.47	440.57	1069.43	717.01

T -- Trace (<.01)

ANNUAL PRODUCTION DATA
FOR
SMILO EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	*	*	*	*	*	*	142.92	*	*
PERENNIAL GRASS	255.37	112.22	99.26	124.64	62.12	77.52	71.34	126.76	49.03
ANNUAL GRASS	132.10	3.46	6.77	.05	5.04	4.28	2.78	0.00	0.00
PERENNIAL FORBS	0.00	0.00	0.00	0.00	0.00	3.55	0.00	0.00	0.00
ANNUAL FORBS	58.85	16.85	21.79	4.80	3.74	60.67	18.86	3.41	0.00
TOTAL	446.32	132.53	127.82	129.49	70.90	146.02	235.90	130.17	49.03

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	147.50	301.36	184.12	148.99	128.33	88.97	163.04	224.67	169.99
PERENNIAL GRASS	44.85	88.59	82.45	133.29	229.28	159.08	80.38	227.17	119.02
ANNUAL GRASS	0.00	6.48	32.65	21.66	37.45	.58	7.20	9.84	15.90
PERENNIAL FORBS	0.00	2.59	0.00	0.00	0.00	.29	0.00	1.25	.45
ANNUAL FORBS	.91	4.13	1.97	.24	3.07	.05	.19	6.53	12.12
TOTAL	193.26	403.15	301.19	304.18	398.13	248.97	250.81	469.46	317.48

* -- No data available.

ANNUAL PRODUCTION DATA
FOR
TWO MILE HILL EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	314.02	306.61	357.60	364.72	120.60	334.18	139.11	193.21	148.52
PERENNIAL GRASS	33.22	4.23	11.15	35.83	180.19	260.91	117.54	25.36	6.04
ANNUAL GRASS	9.40	87.31	345.06	103.45	13.39	497.50	277.39	148.06	38.06
PERENNIAL FORBS	0.00	0.00	0.00	1.61	0.00	.18	15.79	16.90	1.38
ANNUAL FORBS	46.46	0.00	6.45	40.25	.03	50.90	.65	2.97	45.92
TOTAL	403.10	398.15	720.26	545.86	314.21	1143.67	550.48	386.50	239.92

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	318.54	688.92	4.08	56.64	289.42	178.70	121.99	297.80	249.10
PERENNIAL GRASS	66.17	75.32	250.58	212.05	328.95	295.56	283.78	605.13	164.24
ANNUAL GRASS	63.43	419.59	21.00	78.84	145.46	44.47	50.68	89.31	143.08
PERENNIAL FORBS	5.57	1.42	1.69	.99	2.32	1.06	5.23	2.69	3.34
ANNUAL FORBS	163.65	19.81	2.22	17.80	105.56	2.70	.52	40.42	32.14
TOTAL	302.54	1205.06	279.57	366.32	871.71	522.49	462.20	1035.35	591.90

ANNUAL PRODUCTION DATA
FOR
WEST PASTURE EXCLOSURE

YEARS

	1962	1963	1964	1965	1966	1967	1968	1969	1970
SHRUBS	465.10	278.18	261.51	228.15	136.86	344.16	77.80	107.04	94.74
PERENNIAL GRASS	9.70	25.95	40.09	51.44	49.12	120.98	185.58	218.30	228.77
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	63.00	0.00	6.77	2.60	.25	20.52	1.44	1.55	10.94
ANNUAL FORBS	180.20	158.02	177.36	30.00	5.67	10.08	157.02	30.05	1.56
TOTAL	718.00	462.15	485.73	312.19	191.90	495.74	421.84	356.94	336.01

YEARS (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978	MEAN
SHRUBS	368.30	227.29	148.34	168.43	404.00	233.45	203.72	169.49	230.39
PERENNIAL GRASS	165.98	211.55	113.12	38.90	121.37	101.70	53.75	40.92	104.54
ANNUAL GRASS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERENNIAL FORBS	2.88	3.13	4.84	1.20	32.90	11.03	6.87	14.31	10.84
ANNUAL FORBS	4.18	74.58	.32	9.31	14.75	2.61	.86	3.52	50.59
TOTAL	541.34	516.55	266.62	217.84	573.02	348.79	265.20	228.24	396.36

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